SCHOOL OF
CIVIL ENGINEERING

INDIANA
DEPARTMENT OF HIGHWAYS

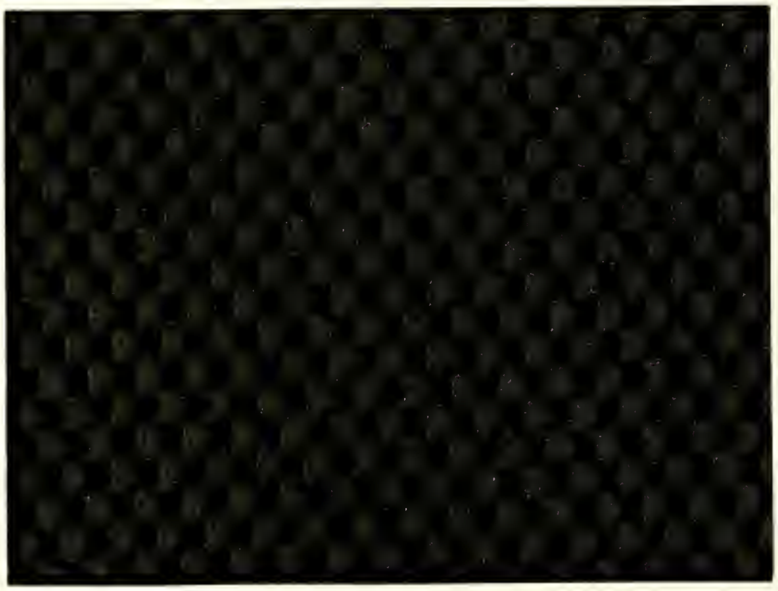
JOINT HIGHWAY RESEARCH PROJECT

JHRP-82-6

ENGINEERING SOILS MAP OF POSEY COUNTY, INDIANA

P. T. Yeh

PURDUE UNIVERSITY



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TO: H. L. Michael, Director
Joint Highway Research Project

April 6, 1982

Project: C-36-51B

FROM: P. T. Yeh, Research Engineer
Joint Highway Research Project

File: 1-5-2-65

The attached report entitled, "Engineering Soils Map of Posey County, Indiana", completes a portion of the project concerned with development of a county engineering soils map of the State of Indiana. This is the sixty-fifth report of the series. The report was prepared by Dr. P. T. Yeh, Research Engineer, Joint Highway Research Project.

The soil map of Posey County was prepared primarily by airphoto interpretation. Test data along interstate I-64 are included in the report. Generalized soil profiles of the major soils for each landform and parent material area are presented on the engineering soils map. An ozalid print of the engineering soils map of Posey County is included in the report.

Respectively submitted,

P.T. Yeh /ms

P. T. Yeh
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PTY/mag

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Final Report

ENGINEERING SOILS MAP OF POSEY COUNTY, INDIANA

by

P. T. Yeh

Research Engineer

Joint Highway Research Project

Project No: C-36-51B

File No: 1-5-2-65

Prepared as Part of an Investigation

Conducted By

Joint Highway Research Project

Engineering Experiment Station

Purdue University

In Cooperation with Indiana Department of Highways

Purdue University
West Lafayette, Indiana
April 6, 1982

ACKNOWLEDGMENTS

The author wishes to acknowledge the assistance given by all those persons who have helped in the preparation of this report. Special acknowledgments are due the members of the Advisory Board, Joint Highway Research Project for their active interest in furthering the study and Professor R. D. Miles in charge of the Airphoto Interpretation, Photogrammetry, and Site Selection Laboratory for review and suggestions.

All 1940 airphotos used in connection with the preparation of this report automatically carry the following credit line: photographed for Commodity Stabilization Service, Performance and Aerial Photography Division, United States Department of Agriculture.

ENGINEERING SOILS MAP OF POSEY COUNTY, INDIANA

INTRODUCTION

The engineering soils map of Posey County, Indiana, which accompanies this report, was done primarily by airphoto interpretation. The aerial photographs, having an approximate scale of 1:20,000 were taken in August, 1940 for the United States Department of Agriculture and were purchased from that agency.

Aerial photographic interpretation of the landforms and engineering soils of this county was accomplished in accordance with accepted principles of observation and inference (1)*. Standard symbols developed by the staff of the Airphoto Interpretation Laboratory of Purdue University's School of Civil Engineering were employed to delineate landforms, parent materials and soil textures. The text of this report largely represents an effort to overcome the limitations imposed by adherance to a standard symbolism and map presentation.

No soil samples were collected and tested by the staff at the Joint Highway Research Project, but general soil profiles were developed and are shown on the soil map. The soil profiles were compiled from the agricultural literature and from the boring data of the roadway soil survey along I-64. These data were supplied by the Indiana Department of Highways. Liberal reference was made to the "Soil Survey of Posey County, Indiana" (2) and the "Formation, Distribution, and Engineering Characteristics of Soil" (3).

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* Numbers in parentheses indicate reference in the Bibliography.

DESCRIPTION OF THE AREA

General

Posey County is located in the extreme southwestern corner of Indiana. Mount Vernon, the county seat of governments is located along the Ohio River about midway between the eastern and western borders. The county is irregular in shape because the boundaries follow the courses of the Wabash River on the west and the Ohio River to the south. The county is bounded on the east by Vanderburg County, on the north by Gibson County, on the west by the White and Gallatin Counties in Illinois and on the south by Union and Henderson Counties in Kentucky (Figure 1).

Posey County has an area of about 414 square miles or 264,960 acres (1,072 sq km) (4). According to the 1974 census of agriculture about 79.6% of Posey County or 184,236 acres (746 sq km) was farmland and about 8.5% or 22,579 acres (91.5 sq km) was woodland (4). The woodlands were generally confined to the steep bluffs of gullies or streams as shown in Figure 2. Posey County had a population of 21,740 in 1970 and 6,770 resided in Mount Vernon as reported by the census (5).

Drainage Features

The drainage systems of Posey County are primarily the Wabash River with a small section contributing water to the Ohio River drainage basin. The central part of the county is drained by the southwesterly flowing Big Creek. McAdoo Creek and Little Fork Creek are the major tributaries of Big Creek from the north and south respectively. The northern part of the county is drained by Black Creek. Big Bayou Creek in the northwest drains the area near Griffen. Cypress Creek in the southeast flows somewhat parallel to the Ohio River and drains a low area west of Heusler.

The flood plains along the Wabash and Ohio Valleys are flat and very wide in places. They were glacial sluiceways. These preglacial valleys were aggraded and form large, low areas. The stream valleys of their tributaries were also aggraded toward the upland for some distance and turned into huge slackwater plains and/or lacustrine plains.

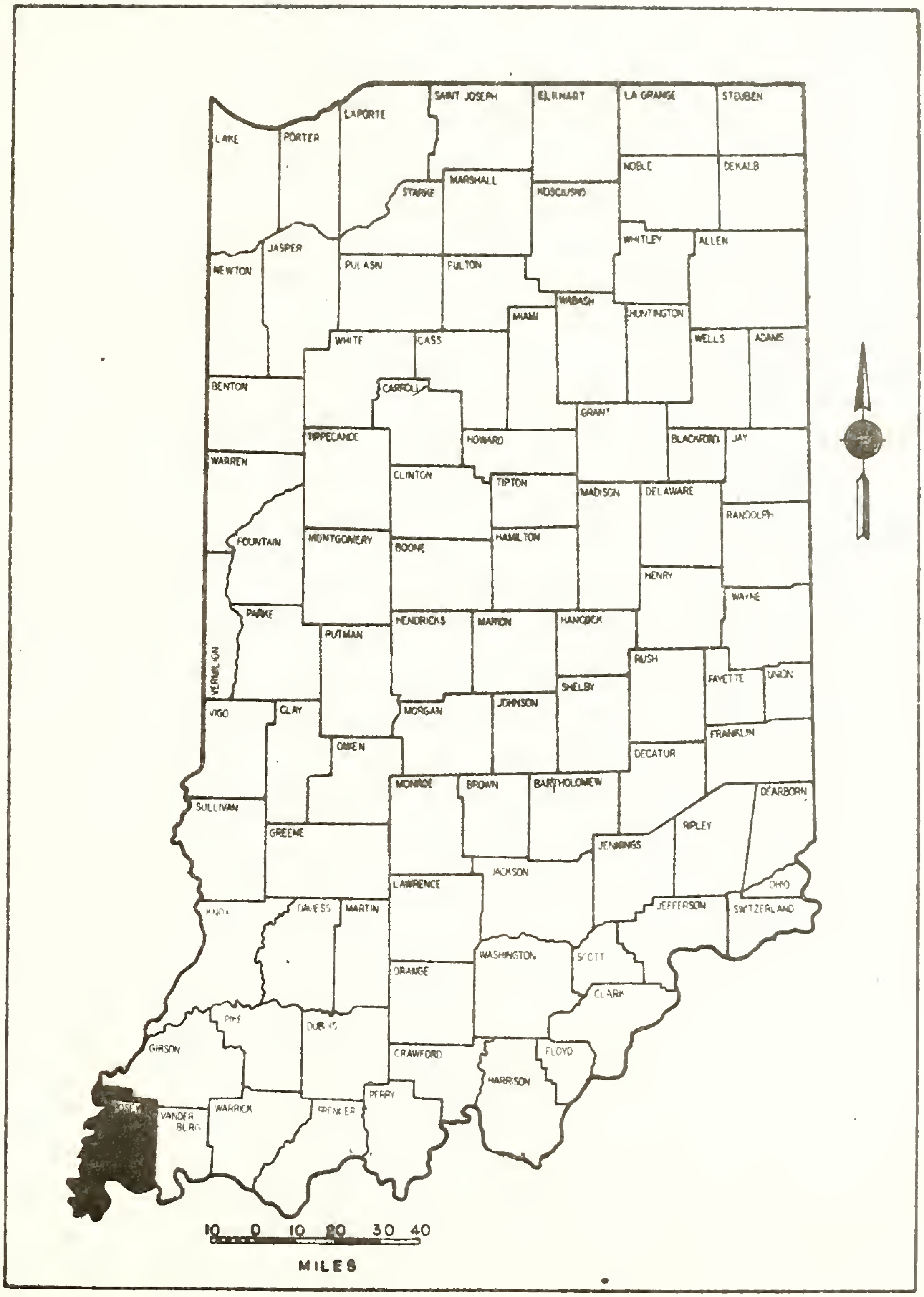

FIG. I LOCATION MAP OF POSEY COUNTY

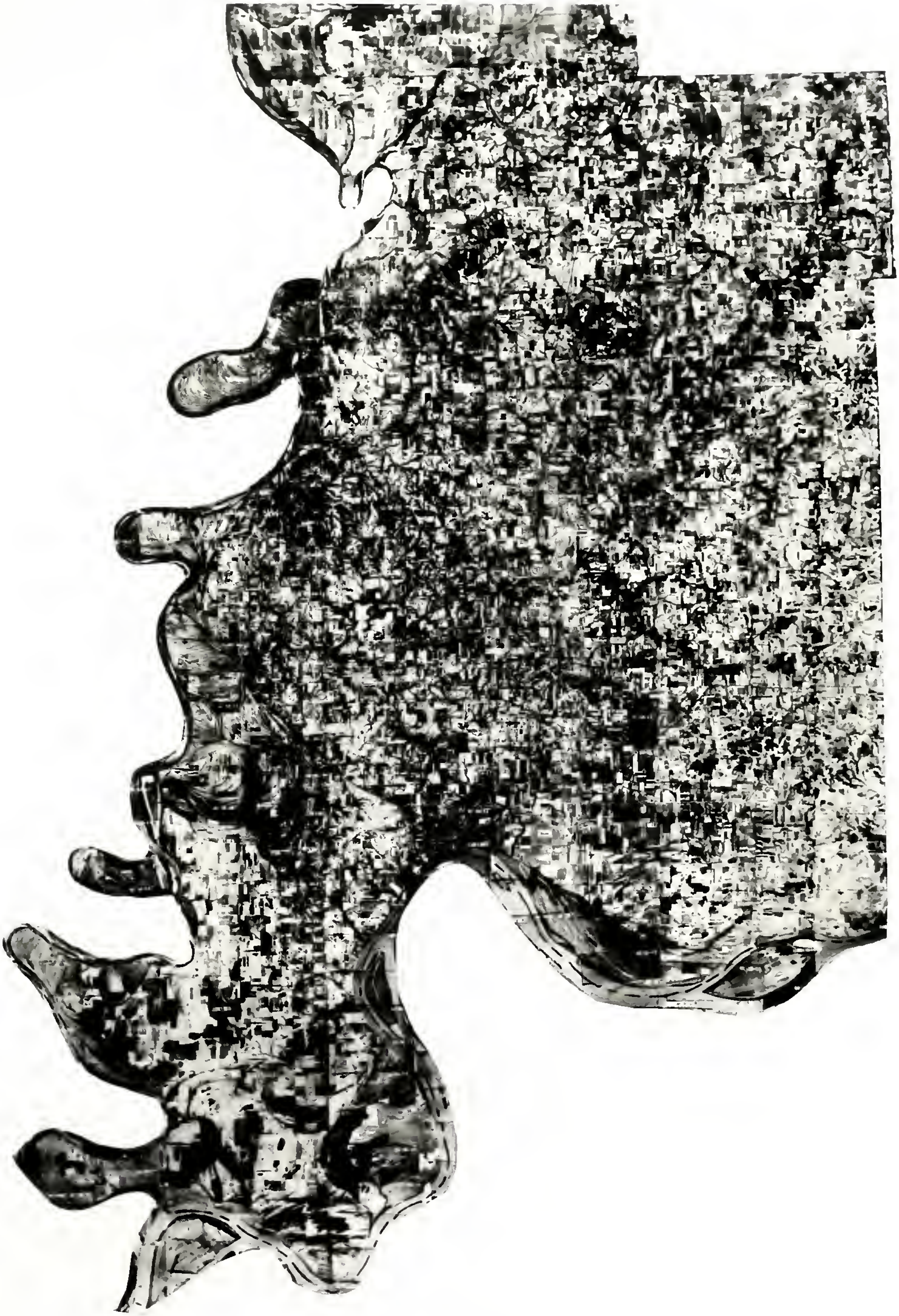

FIG. 2. AIRPHOTO MOSAIC OF POSEY COUNTY, INDIANA

FROM 1940 INDEX MAP

Fine integrated drainage systems are well developed in the upland areas. Noticeable abrupt changes in the course of Big Creek and Black River and Creshen Creek near New Harmony may be caused by glaciation (See Figure 3). The Wabash River flows against the bedrock of the valley wall at a point south of New Harmony and the rapids of the Wabash occur along this reach of the river. A large oxbow meander channel was formed in this area when a flood cutoff channel was formed on the present Wabash River. The lakes of Posey County are the water-filled abandoned meanders or bayous and oxbows along the Wabash and Ohio Rivers. The largest one is Hovey Lake on the Ohio River flood Plain southwest of Mount Vernon. Ponds of various origins are scattered throughout the area, and most of these are man-made stock ponds.

Numerous ditch systems have been dredged in the alluvial sections especially on the flat lacustrine plains to improve slaggish drainage conditions and to eliminate swamp conditions.

Climate

The climate of Posey County is continental, humid and temperate, with hot summers and moderately cold winters. The mean annual precipitation is 43.18 inches (110 cm) at Mount Vernon. Average seasonal snowfall is 12 inches (30.5 cm). The mean and extreme temperature and precipitation is shown in Table 1.

The largest 1-day rainfall during the period of record was 5.13 inches (15.0 cm) at the station on January 21, 1957. Thunderstorms occur mostly in the summer months (6).

Physiography

Posey County lies wholly in the Wabash Lowland province of the state (Figure 4). With respect to its physiographical situation in the United States, the northwestern portion of the county is in the Till Plains Section of the Central Lowland province and the remainder is in the Aggraded Valley Section of the Interior Low Plateaus province (7).

The Wabash Lowland in Posey County is characterized by intensive areas of alluvial, slackwater, and lacustrine deposits. The evidence of filled-in or aggraded valleys is observed readily on the aerial photographs.

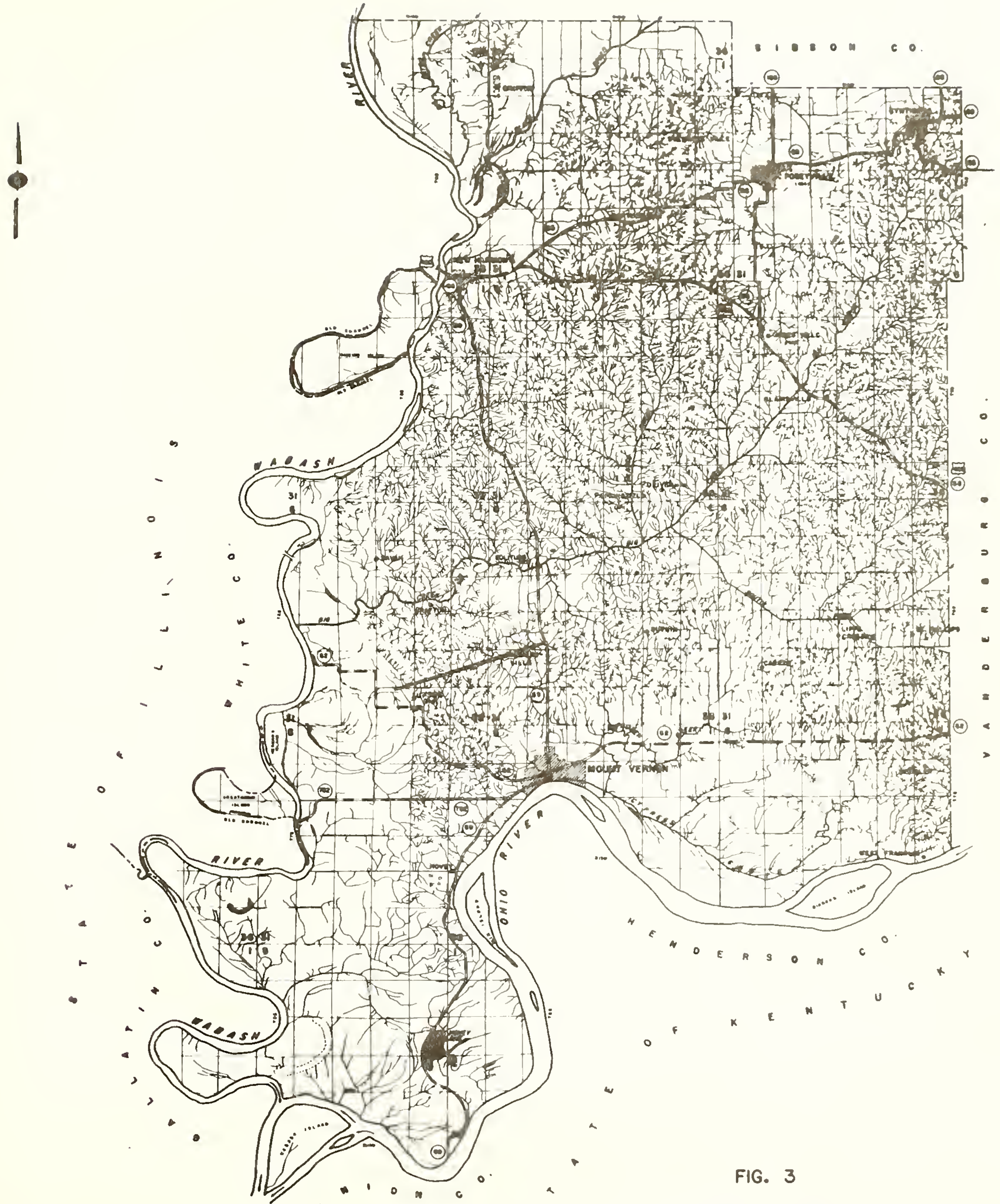

FIG. 3

DRAINAGE MAP

POSEY COUNTY

INDIANA

Table 1. Means and Extremes Monthly Temperature and Precipitation at Mount Vernon, Posey County, Indiana for period 1951-1974

	Temperature (°F)							Precipitation (inches)					
	Means			Extremes							Snow Sleet		
Month	Daily Maximum	Daily Minimum	Monthly	Record Highest	Year	Record Lowest	Year	Mean	Maximum Monthly	Greatest Daily	Mean	Maximum Monthly	Greatest Daily
January	40.6	22.5	31.6	71	67	-13	63	3.17	7.86	5.13	3.4	10.5	9.0
February	44.5	25.5	35.0	78	62	-10	51	3.17	7.13	2.74	3.0	12.0	9.0
March	53.4	33.4	43.4	82	67	-3	60	4.67	12.68	3.24	2.5	18.8	12.0
April	67.0	45.3	56.2	89	65	24	61	4.30	7.32	3.40	.5	8.5	4.0
May	76.8	54.1	65.5	95	62	31	66	4.71	13.77	4.84	.0		
June	85.7	62.9	74.4	105	54	43	69	3.74	7.72	2.58	.0		
July	89.2	66.4	77.8	105	66	50	71	3.90	7.79	3.19	.0		
August	88.1	64.0	76.0	103	64	44	65	3.16	8.71	2.56	.0		
September	82.5	57.1	69.9	107	53	35	74	2.80	7.35	3.55	.0		
October	71.5	45.0	58.3	96	53	23	52	2.46	6.41	2.37	.0		
November	56.0	34.7	45.4	83	55	4	58	3.57	8.69	2.64	.9	8.0	7.0
December	44.2	26.6	35.4	72	70	-6	62	3.53	7.00	1.80	2.0	10.7	6.0
Year	66.6	44.8	55.7	107	53	-13	63	43.18	13.77	5.13	12.3	18.8	12.0

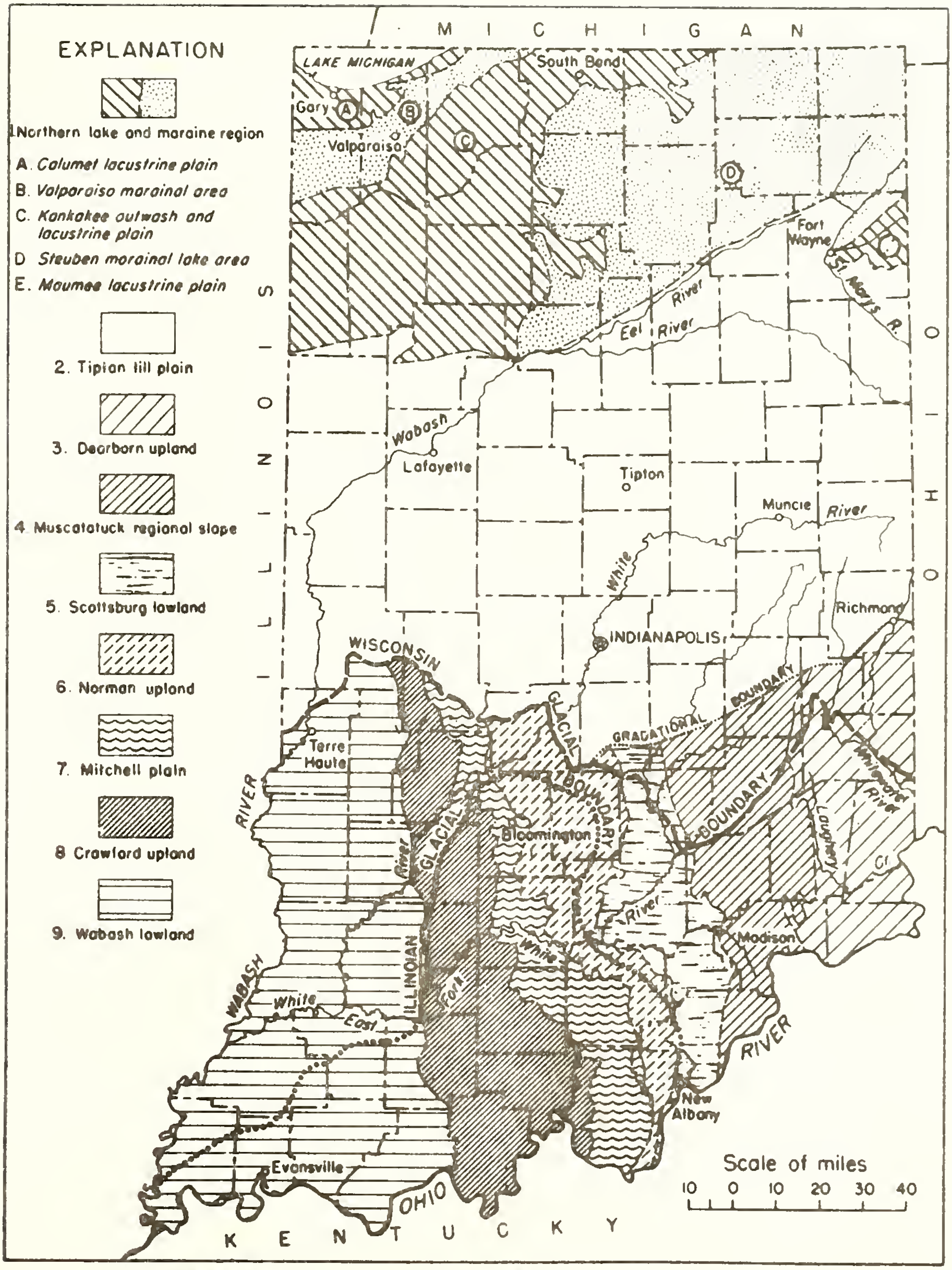

Figure 4 Map of Indiana showing regional physiographic units based on present topography. Modified from Malott

Topography

The topography of Posey County consists of rolling uplands and broad flat bottom lands (See Figure 5). The uplands are characterized by gently sloping ridgetops and moderately sloping to steep side slopes. The steeper side slopes occur generally near the rivers and streams. The uplands are dissected by numerous gullies, streams, and drainageways; therefore, the topography is rolling.

The broad flat bottom land are nearly level. These large, flat plains are usually associated with the rivers and streams. These plains are at different elevations and are generally separated by low, abrupt slopes into flood plains terraces and lacustrine plains. The lacustrine plains usually are situated at the highest position with a near level topography. The lacustrine plains extend to a considerable distance from the rivers into the upland along the valleys. The terraces, however, are located closer to the rivers and slightly higher than the flood plains but lower than the lacustrine plains. The surface of the terrace are generally flat with low swales formed by the currents during deposition. The broad flood plains along the Wabash and Ohio Rivers are most spectacular from the aerial photographs. The abandoned meanders, oxbows and the current scars transform the usually featureless bottom land into a complex curvilinear pattern extending along the Wabash and the Ohio Rivers.

Some hummocky topography is found along the eastern bluff of the Wabash River. This is associated with the windblown sand or sand dune deposits of Posey County. They are slightly higher than the finer silt deposits to the east.

The highest point in Posey County is about 580 ft (177 m) above sea level. It is located in Sec. 13 T5S. R12 W near the junction of St. Wendel Road and Island Road about 1.5 miles (2.4 km) southwest of the town of St. Wendel. The lowest point is about 335 ft (102 m) above sea level. It is located on the flood plain at the junction of the Wabash and Ohio Rivers at the southwestern tip of the county. Local relief of about 150 ft (45 m) is located along the bluff of Mumford Hills in Sec. 31, T3S. R 13 W. This region is a hill of circumnavigation within the Wabash River flood plain and is a rock defended remnant of the upland to the east.

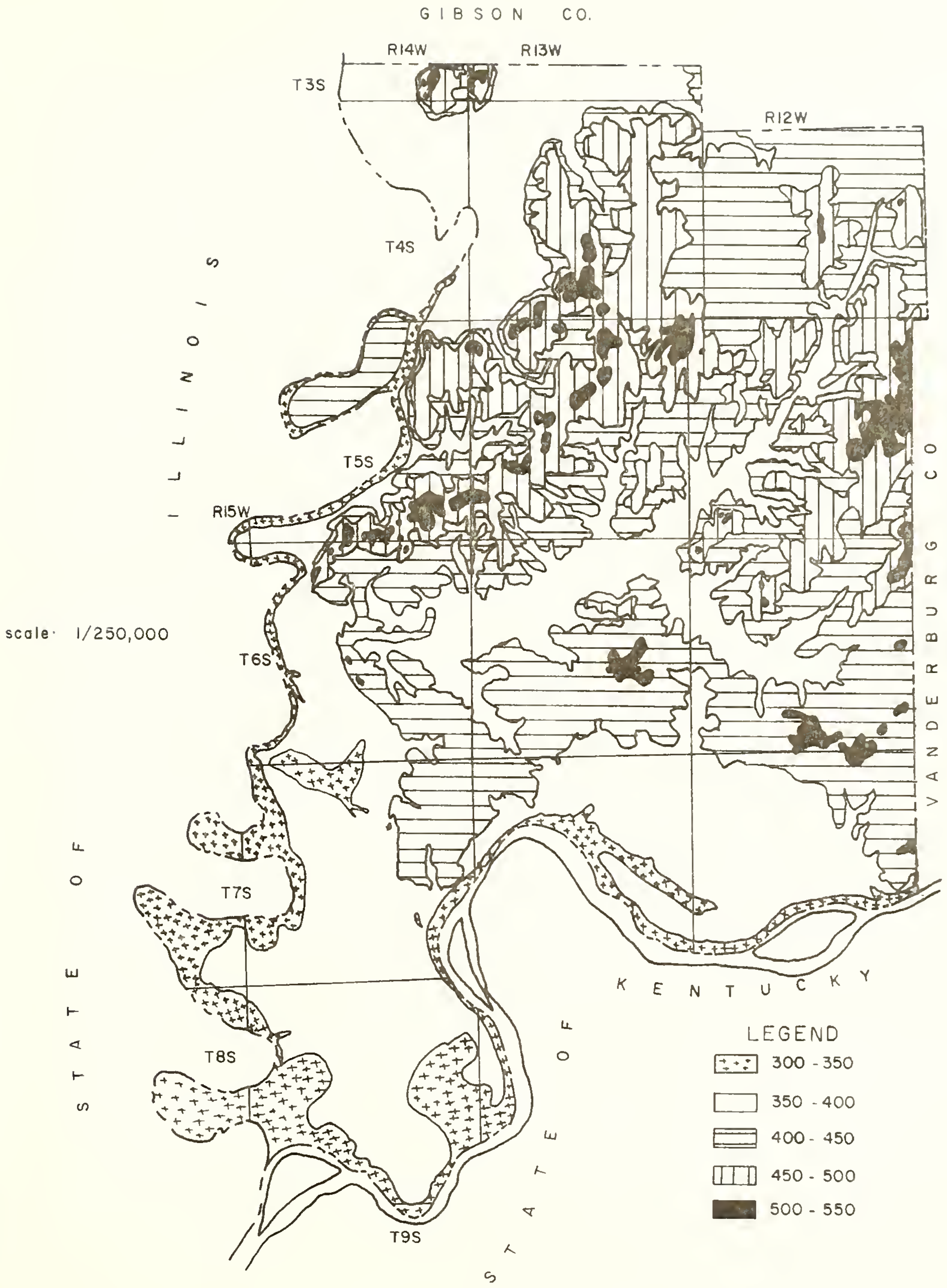

FIG. 5 TOPOGRAPHIC MAP OF POSEY COUNTY

Geology

The surface and near surface geologic ages represented in Posey County are the Quanternary period and the bedrock of Paleozoic age. The Quaternary materials are both Pleistocene and recent in age.

The general surface deposits of the county are shown in Figure 6. Large areas along the Ohio River and Wabash River are classified as clastic sediments of silt, sand, and gravel of the Martinsville Formation by Wayne (8). The area immediately to the north and a few feet higher than the Martinsville formation along the Ohio River and a narrow strip along the Wabash River in the vicinity of New Harmony is classified as the valley train deposits or outwash facies of the Atherton Formation. It contains gravel, sand, and silt, and is more sandy and gravelly than the adjacent flood plain deposits. A few small areas on the upland east of the Wabash River are recognized as dune facies of the Atherton Formation by Wayne.

A considerable area along the tributaries of the Wabash River and the Ohio River are classified as the lacustrine facies of the Atherton Formation. The upland area is the eolian silt deposit classified as the loess facies of the Atherton Formation. The northwestern portion of the county is underlain by Illinoian drift, as shown in Figure 4 (9). The drift is reported in the loess distribution study by Fehrenbacher (10), and the thickness of the loess is illustrated in Figure 7 and Appendix A.

The bedrock underneath the conconsolidated surface material in Posey County are all of the McLeansboro Group of the Pennsylvanian Series. Shale, sandstone, limestone, and thin coal seams are the materials to be found in this group of bedrocks. Most of the county is underlain by the lower part of the McLeonsboro Group. The northwestern quarter and some scattered "islands" or hills of circumnavigation on the eastern half of the county, however, belong to the middle part of the group. Some small areas in the extreme northwestern tip of the county are classified as the upper part of the formation (See Figure 8).

The top of the West Franklin limestone member within the lower part of the McLeansboro Group is shown as a heavy dash line on the map. A number of fault lines are also shown in Figure 8. A generalized stratigraphic column of the Pennsylvania formation in this county is shown in Figure 9.

Bedrock exposures are found in a number of places. Most of them occur at the foot of the bluff of the major drainage channels as illustrated in Figure 8.

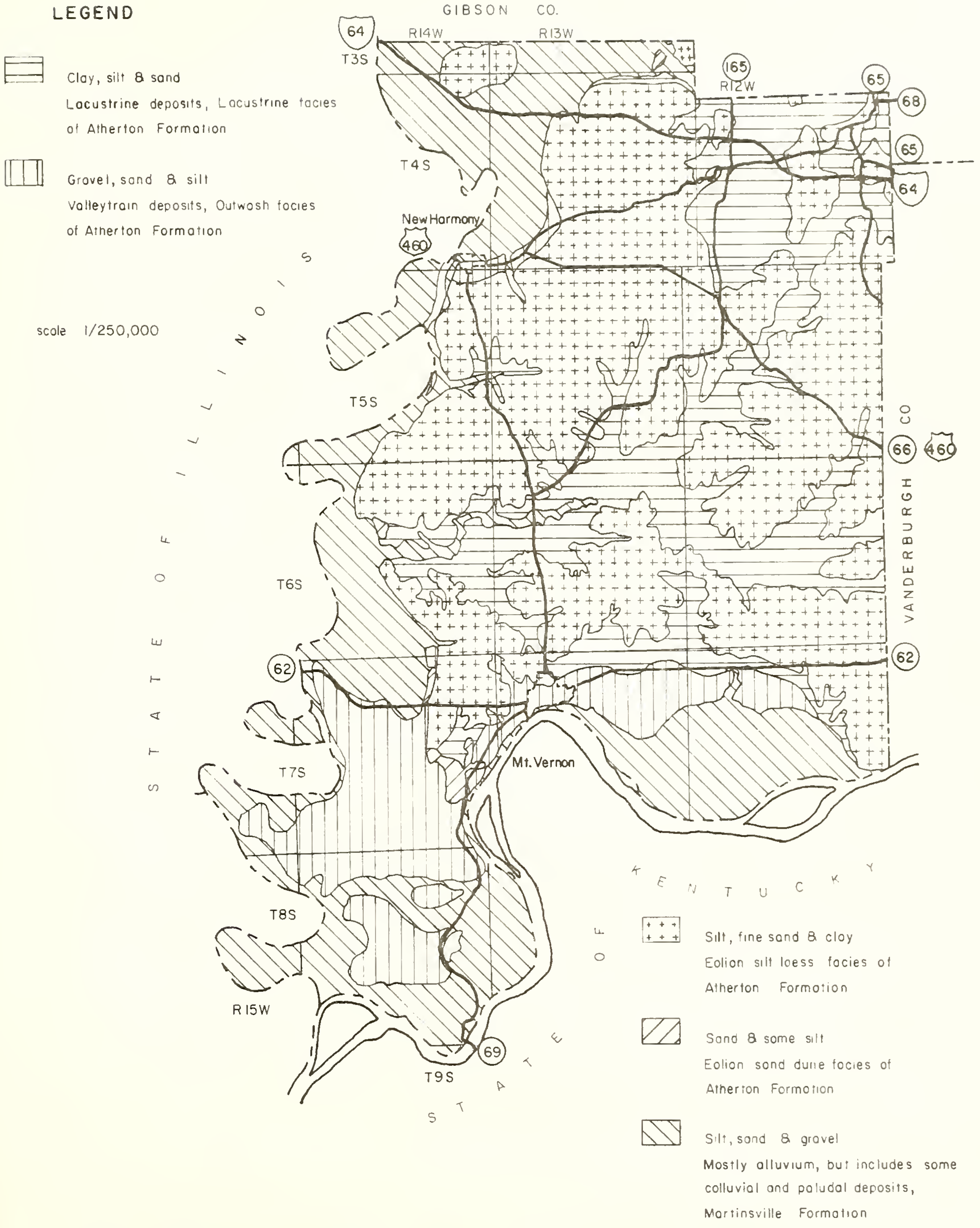
LEGEND
Clay, silt & sand
Lacustrine deposits, Lacustrine facies of Atherton Formation
Gravel, sand & silt
Valleytrain deposits, Outwash facies of Atherton Formation
scale 1/250,000
Silt, fine sand & clay
Eolian silt loess facies of Atherton Formation
Sand & some silt
Eolian sand dune facies of Atherton Formation
Silt, sand & gravel
Mostly alluvium, but includes some colluvial and paludal deposits, Martinsville Formation
GIBSON CO.
VANDERBURGH CO
STATE OF ILLINOIS
STATE OF KENTUCKY
New Harmony
Mt. Vernon
R14W
R13W
R12W
R15W
T3S
T4S
T5S
T6S
T7S
T8S
T9S
64
165
65
68
65
64
460
66
460
62
62
69

FIG. 6 UNCONSOLIDATED DEPOSITS IN POSEY COUNTY

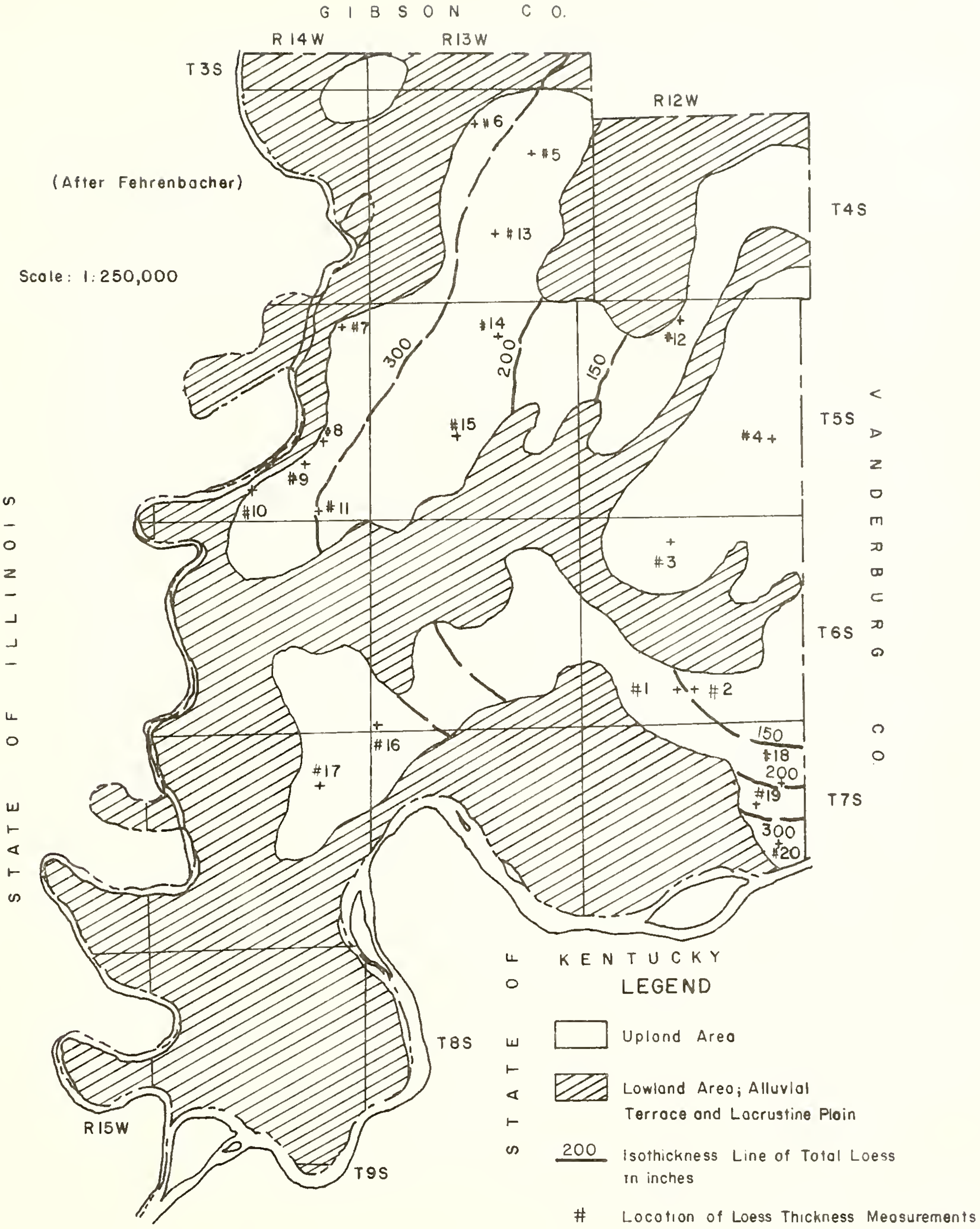

FIG. 7 ISOPACHOUS MAP OF TOTAL LOESS IN POSEY COUNTY

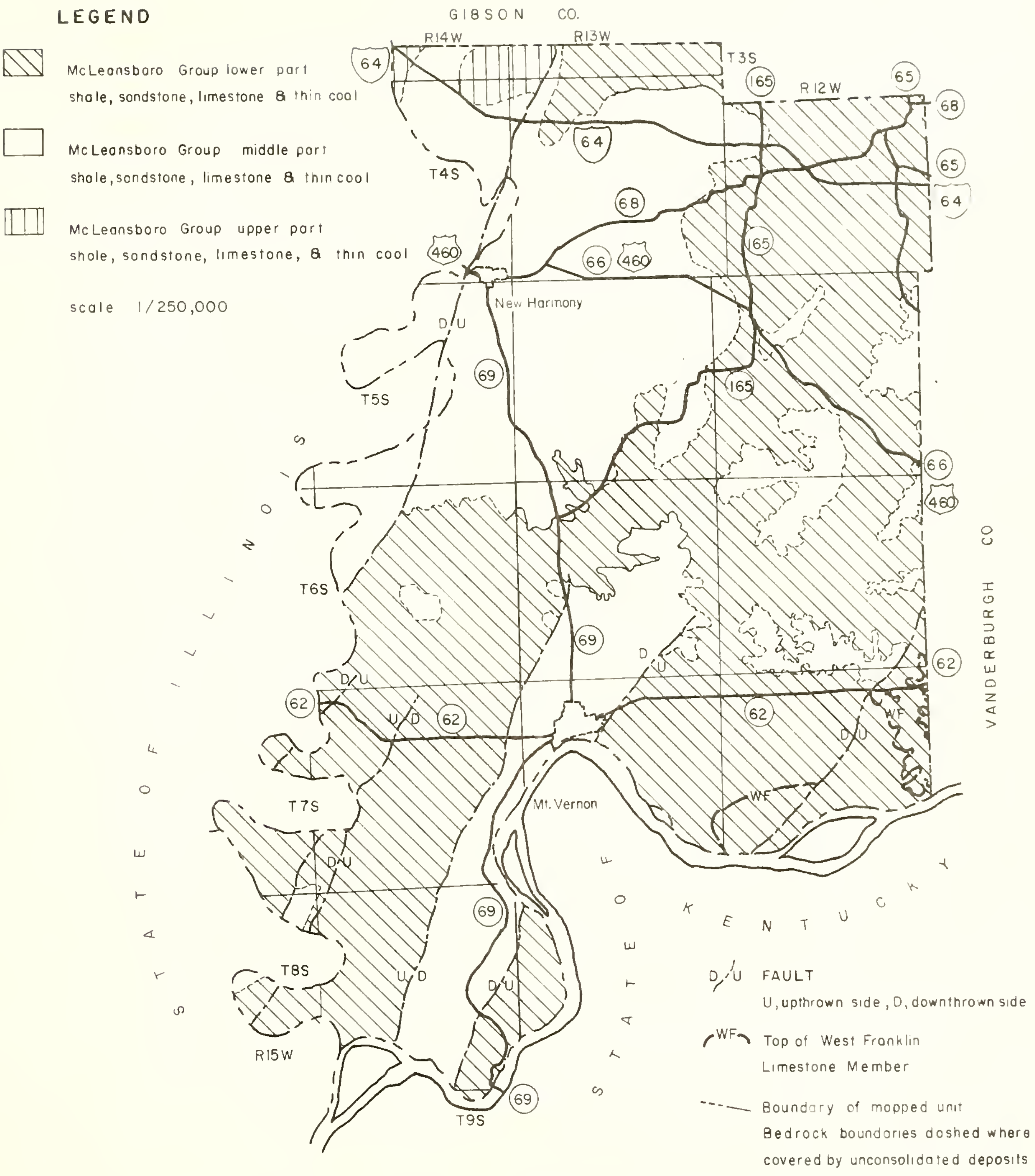
LEGEND
▧ McLeansboro Group lower part
shale, sandstone, limestone & thin coal
☐ McLeansboro Group middle part
shale, sandstone, limestone & thin coal
▥ McLeansboro Group upper part
shale, sandstone, limestone, & thin coal
scale 1/250,000
GIBSON CO.
R14W
R13W
R12W
R15W
T3S
T4S
T5S
T6S
T7S
T8S
T9S
64
165
65
68
66
460
69
62
New Harmony
Mt. Vernon
D/U
U/D
WF
STATE OF ILLINOIS
STATE OF KENTUCKY
VANDERBURGH CO
D/U FAULT
U, upthrown side, D, downthrown side
WF Top of West Franklin Limestone Member
Boundary of mapped unit
Bedrock boundaries dashed where covered by unconsolidated deposits

FIG. 8 BEDROCK FORMATION OF POSEY COUNTY

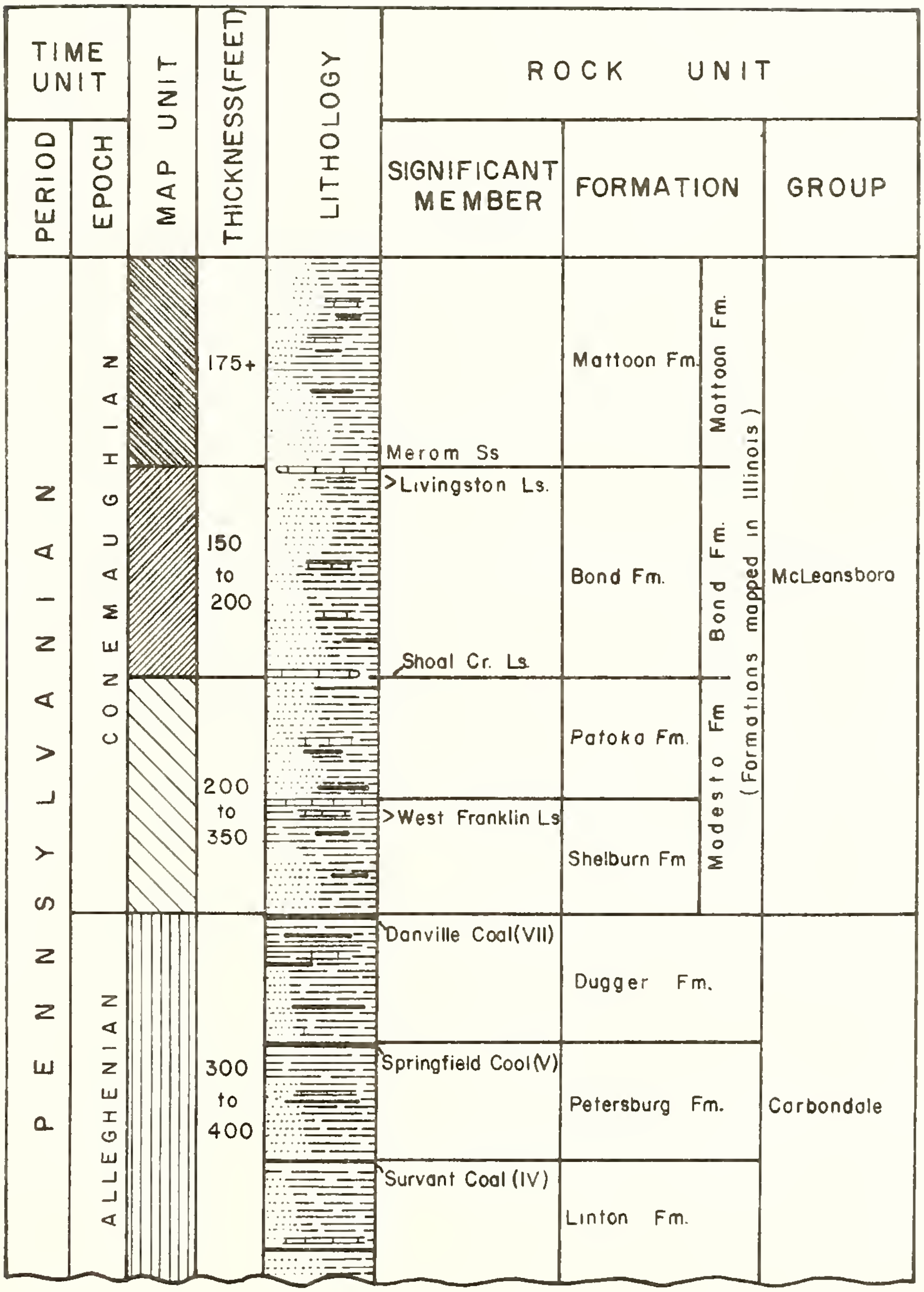

FIG. 9 COLUMNAR SECTION SHOWING BEDROCK UNITS IN POSEY COUNTY.

LAND FORM AND ENGINEERING SOIL AREAS

The engineering soils in Posey County are derived mainly from unconsolidated materials (See Figure 6). The unconsolidated materials includes fluvial deposits and eolian deposits. A very limited area is considered as residual soil or non-soil area. However, due to the scale limitation of the attached soil map many narrow strips of rock outcrops along the valley wall of streams are not shown.

The entire county essentially is covered by loess deposits of various depth as indicated in Figure 7 and Appendix A. The deepest deposit occurs on the western upland and the depth decreases toward the east. The depths of loess are measured on the flat areas where erosion of the deposit is at a minimum. Therefore, the soil areas within this region are subdivided according to the depth of the loess deposits and its erosional conditions.

The deposits of transported materials are not homogeneous and variation is expected. General properties and profiles of the soils for each area of different land form are illustrated in this report.

Eolian Deposited Materials

There are extensive eolian (wind) deposits in Posey County. The eolian deposits are subdivided into two groups: sand deposits and loess deposits.

1. Windblown Sand Deposits:

Windblown sand deposits occur only along the bluff of the Wabash River in Posey County. The largest strip is located east and northeast of New Harmony. Another mass occurs about two miles (3.2 km) south of New Harmony. A narrow strip near the town of Upton, a small dune mass south of the town of Savah and a dune mass near the northern border of the county are the locations of the other conspicuous windblown sand deposits. A very narrow strip of sand ridges occur at the western and southern edges of Mumfort Hill, the rock core island of the Wabash River flood plain at the northwestern corner of the county.

Most of the sand dune deposits are high above their adjacent terrace or flood plains, in a relief that varies from 60 to over 100 feet (18 to 30 m). The only exception is the one located near the north central border where the elevation difference between the adjacent terrace is only about 30 feet (9 m). The sand dune pattern is recognized on the airphotos easily. The pitted drainage basins between the dunes assist in the recognition.

Although the materials of the sand dunes are predominantly fine, uniform windblown sand, a considerable amount of silt and some clay particles are mixed with the sand. The texture of the dune is coarser in the windward side and finer in the leeward side.

The soil profile of the sand dune deposit consist of a fine sandy loam top soil (A-4) with a sandy clay loam to loam (A-6) subsoil. A silty clay loam (A-6) usually underlies the loam soil and a fine sandy loam (A-4) texture appears further down before fine sand or silt (A-3 or A-2-4) parent material is reached.

Since the sand dune deposits in Posey County vary widely in texture, engineers should be award of the different characteristics of the silty and sandy soils and design accordingly.

2. Windblown Silt Deposits:

All of the upland in Posey County is covered by windblown silts or loess. The loess deposits are subdivided into groups according to the depth of the loess and the type of underlying materials. The subdivision are: (a) deep loess deposit, (b) loess covered sandstone-shale, (c) loess covered lacustrine plain, and (d) sandstone-shale with a loess veneer.

(a) Deep Loess Deposits

More than one third of Posey County is considered as deep loess deposits. As indicated by the data (See Figure 7 and Appendix A) the loess is over 300 inches (7.6 m) at the south and western edge of the upland. It decreases rapidly toward the east. However, no less than 100 inches (2.5 m) is found on the ridge top areas (#3 and #4 on the map) near the eastern border. This thick loess deposit is underlain by Illinoian drift in the northern half and interbedded sandstone and shale bedrock in the south half of the county. The boundary between them is difficult to delineate from the airphotos because of the thick loess mentle. The density of the drainage, however, is slightly denser in the sandstone-shale bedrock region than the Illinoian drift region.

The elevation of the ridge tops generally vary from 470 feet to 500 feet (143 to 153 m) above sea level. On the western portion where the loess deposit is thicker, the topography varies from gently rolling to rolling. The most unusual pattern is found on the Mumfort Hills area where a "sink-holes-like" appearence is shown. According to Moultrop in his thesis entitled, "Airphoto Boundary Delineation of Loess or Loess Like Soils in Southwestern Indiana" (11) water collects in these shallow basins during periods of heavy rainfall. No sand was found in the depression but a compact clayey-silt layer developed at approximately 15 to 18 inches (38 to 46 cm) from the surface.

Because loess is subject to intensive erosion, dissection is widespread. The erosional gullies tend to form at right angles to many of the drainage ways. The pinnate drainage pattern is observed in many areas (See Figure 3). The classical feature for deep loess such as pinnacle and fins in not observed on the airphotos because of vegetative cover. However, the near-vertical cut along the highway, the U-shaped gully and the vertical sloughing along the gully are obvious indicators of the deep loess deposits.

The loess deposits in Indiana has been mapped previously by Moultrop on a regional basis (11). Some minor changes or refinements have been made for this county engineering soils map.

The soil profile of the deep loess deposit has a silt loam or silty clay loam (A-4 or A-6) soil in the A-horizon. The B-horizon is a more plastic silty clay loam, silty clay or clay (A-6 to A-7-6). The C-horizon ranges from silt loam to silty clay loam (A-4). The interbedded snadstone and shale bedrock generally occurs more than ten feet (3 m) below the surface.

Soil boring data along I-64 varify the profiles in general (12, 13, 14, and 15). Most of the top soils are classified as silt loam (A-4 to A-6) soil. However, in a number of places a silty clay loam or silty clay (A-7-6) soil is found from the surface down such as at site Nos. 50, 51, 53, 54, 56, 59, 60, 64, 65, 66, 68, 70, 73, 76, 78, 79, and 99. A thick layer of silt loam (A-4) is usually followed by the underlying Illinoian drift in the north and the sandstone and shale in the south.

The thickness of the loess is observed in the boring at site No. 36. The boring was taken at an elevation of 468.5 feet (143 m) above sea level which is about 90 feet (27 m) higher than the adjacent terrace on the west. Beneath 0.8 feet (20 cm) of silt loam topsoil there is 36.0 feet (11 m) of silt loam (A-4) soil and then a 6.5 feet (2 m) of clayey (A-7-6) soil with a trace of gravel. Further down the profile is a 2.5 feet (76 cm) layer of sandy loam (A-4) and this is followed by 2.0 feet (60 cm) of clay loam (A-4) soil with a trace of gravel. Therefore, it is obvious that the loess in this site is about 32.8 feet (11.2 m) over the Illinoian drift or outwash deposit (See Appendix B). At the eastern end, such as at site No. 107, the profile shows that under the 1.3 feet (40 cm) of topsoil there is a 6.3 foot (1.9 m) layer of silty clay loam (A-4) soil and 4.0 feet (1.2 m) of silt loam (A-4) before 12.0 feet (3.6 m) clay loam (A-6) soil (likely to be the Illinoian drift) is encountered. Therefore, the loess at this site is about 11.6 feet (3.54 m) in thickness. This also verifies the loess thickness given in Figure 7 by Fehrenbacher.

Occasionally a layer of sand or sandy loam may be interbedded in the thick loess. At site No. 38 for example, a 9.5 foot (2.9 m) layer of sand which contains 88 percent of sand, 5 percent of silt and 7 percent of clay classified as (A-2-4) soil is found under 2.0 feet (60 cm) of silty clay (A-7-6) top soil and 3.5 feet (1.1 m) of silt loam (A-4) subsurface soil on 24.5 feet (7.5 m) of silt loam (A-4) soil. At sites No. 50 and 51, a thinner layer of sandy loam 1.6 to 1.2 feet (45 cm to 36 cm) thick underlys 2.5 to 4.5 feet (76 cm to 1.38 m) of silty clay (A-7-6) topsoil and 1.8 to 15 feet (55 cm to 45 cm) silt loam (A-4) subsurface soil respectively. In general, a coarser textured soil is found at the bottom of the gullies.

The engineering problems in the region are primarily the control of moisture during construction and compaction of the silty material. The subgrade becomes weak under adverse moisture or due to frost action in winter. Pumping and embankment erosion are the likely problems.

(b) Loess Covered Sandstone-Shale

The loess covered sandstone and shale areas are confined to the eastern half of Posey County. They are located on the side slopes of the ridges and along the drainage channels. Most of them are rather limited in size and scattered. The area generally slopes in a range of 12 to 30 percent. The original thick loess deposit is removed by erosion. The bedrock is usually six feet (2 m) below the surface.

The upper soil profile is derived from the loess material. Therefore, it is essentially the same as the soil profile of the deep loess deposits except that bedrock may be encountered in a depth of about six feet (2 m) from the surface. Since the area northwest of Big Creek contains the Illinoian drift, a thin drift is encountered underneath the loess mantle before the sandstone-shale bedrock is reached. The top soil is primarily a silty clay loam (A-4 to A-6) soil. Soil textures classified as silt loam (A-4) and silty clay (A-6) are also found in the top layer. The subsurface soil is predominantly silty clay loam (A-4 to A-6) soil. A fragipan may be found about 30 inches (75 cm) from the ground surface. The subsoil is the more friable silt loam or silty clay loam (A-4 to A-6) soil. The weathered sandstone-shale residual soil occurs as sandy loam silt loam, or clay loam under the loess deposits. Rock fragments are present near the sandstone and shale bedrock. In the region north and west of Big Creek a silty clay or clay loam (A-4 to A-6) soil of the Illinoian drift origin is encountered.

The engineering problems associated in this area are the cuts and fills associated with the relief and the supporting strength, compaction, erosion and frost action problem of the loess soil.

(c) Loess Covered Lacustrine Plain

Considerable areas in the northeastern quarter of Posey County are mapped as loess covered lacustrine plain. These deposits are closely associated with the lacustrine plains but are somewhat higher in elevation than the adjacent lacustrine plains. Usually they are along the edges of the lake plain deposit and merge gradually with the loess upland.

The surface of this deposit exhibits an undulating or gently rolling topography. Many low hills are found within the rather flat lake plains deposits. Light and dark tones appear in the high and low areas of the deposit. The surface drainage in most areas are not well developed except as man-made ditches. However, in some areas due to local relief surface drainage systems are well established such as those areas located three to five miles (4.8 to 8.0 km) east and northeast of New Harmony. These two isolated deposits occur at a rather high altitude (440 feet to 460 feet or 134 m to 140 m above sea level). The basin-like topography of the deposits is easily delineated from the high and more rolling surrounding uplands.

Smaller areas are scattered along the edges of the larger lacustrine plains in the southern portion of the county and are recognized as the loess covered lacustrine plain. They are generally 10 to 20 feet (3 to 6 m) higher in elevation than the adjacent lacustrine plain.

The normal airphoto characteristics of the lacustrine plain are obliterated entirely by the loess blanket. The patterns are more like the loess deposits than that of the lacustrine deposits. However, surface drainage systems except for those two isolated areas mentioned above, are poorly developed.

The soil profile is essentially the same as that of the loess covered sandstone-shale deposit except that the underlying strata is lacustrine instead of sandstone and shale which is encountered at greater depth. The top soil varies from a silt loam in the high positions to a silty clay in the low depressions. The B-horizon is more clayey in texture but ranges from silty clay loam to silty clay (A-4 to A-6 soil and A-7-6 at lower areas). The C-horizon is composed of silty clay loam to silty clay (A-4 to A-6) soil. The underlying lacustrine deposits are stratified silt loam or silty clay loam with some thin sandy layers occasionally.

Boring sites No. 85 and 86 are located within this deposit. At site No. 85 the surface is at an altitude of 426.4 feet (130 m). The 0.7 feet (17.5 cm) of topsoil is classified as silty clay (A-7-6)

and is underlain by 13.3 feet (4.05 m) of silt loam (A-4) and then 4.0 feet (1.2 m) of silty clay (A-7-6) lacustrine soil. At site No. 86, with a surface elevation of 422.8 feet (128 m), the profile is about the same. Under 1.0 foot (25 cm) of silty clay (A-7-6) topsoil there is 12.0 feet (3.6 m) of silty loam (A-4) soil. Both of the sites are about 12 to 17 feet (3.65 to 5.2 m) higher than the surface elevation of the nearby lacustrine plain. The sample taken from 9.0 to 10.0 feet (2.74 to 3.05 m) contains 88.4% to 82.2% of silt respectively.

The engineering problems associated with this soil are essentially the same as those in the loess covered sandstone-shale region. However, if deep cuts are required, the problem of weak support by the lacustrine deposit needs to be taken into account.

(d) Sandstone - Shale With Loess Veneer

The sandstone-shale with loess veneer soil is scattered in the eastern portion of Posey County. The soil is confined to the valley wall areas. Erosion is removing some of the loess deposit and where very severe some of the residual soils of the sandstone and shale. The topography of this region is extremely rugged and blocky. Gullies are carved into the sandstone-shale bedrock at their upper reaches. Gullies are numerous and closely spaced. A white fringe which reflects the bare soils or rocks of the area is observed on the aerial photographs.

The central part of the area as mapped, is severely eroded and much of the loess cover is removed. In places part of the subsoil is eroded leaving a truncated soil profile. Only at the lower reach of the gullied areas where the slopes are more gentle is the surface soil retained to support the growth of vegetation.

The soil profile varies greatly depending on the topographic position and erosional situation. On a normal soil profile a silt loam or a silty clay loam (A-4) topsoil prevails. It is underlain by a silty clay loam to clay subsurface soil (A-4 to A-6) and or silt loam or silty clay loam subsoil (A-4 to A-6). The residual

soils with a texture of sandy loam, loam or clay loam occurs with considerable amount of stone fragments before the interbedded sandstone and shale bedrock is reached. In places, where the erosion is severe, the top layers are removed and the underlying bedrock exposed. This is considered as non-soil area.

The enigneering problems associated with this region are associated with the variability of materials within cuts and fills. Different types and characteristics of residual soils or bedrock are encountered within a short distance. Soil stabilization or erosion and gully control is another problem for the engineer.

Fluvial Deposited Materials

More than sixty percent of Posey County is covered by fluvial deposited materials. Three different land forms created by the action of water namely, lacustrine (slack water) plain, terrace, and flood plain are discussed.

1. Lacustrine (slack water) Plain:

Three huge lacustrine plains are recognized in Posey County. They are deposits of the Wisconsian glacial lakes developed during the Wisconsian glacial period (16, 17). The surface of the southern lacustrine plain along the Ohio River is at an altitude of 380 to 400 feet (116 to 122 m) above sea level. Glacial Lake Solitude which contains Big Creek, is at the same altitude. The lacustrine deposits further up stream along Big Creek and in the upper reaches of the tributaries are much higher in elevation and occur at an elevation of 430 feet (131 m above sea level). The lacustrine plain mapped in the northern part of the county, site of glacial lake Poseyville, is slightly higher than the previously mentioned lacustrine plain. The lower part is at an elevation of about 407 feet (124 m) to 420 feet (128 m). The higher portion varies from 420 to 440 feet (128 to 134 m). The isolated lacustrine plains located in the upper reaches of the tributaries range in altitude from 440 to 460 feet (134 to 143 m) above sea level.

In general, the surface of the lacustrine plains is flat or very gently sloping. The surface is smooth, featureless and devoid of natural surface drainage development. The airphotos show a uniform medium to dark grey tone. However, the region at the lower end of Big Creek and adjacent

to the stream is much lighter in tone and the surface drainage systems are much better developed. Because of the low relief many ditches are dredged within the larger lacustrine plains to facilitate the drainage. In the larger slack water plains, the uniform dark tone is broken occasionally by scattered small light tonal mounds which indicates a better drainage position of the slightly higher thin loess deposits accumulated on the plain. Since the mounds are small and the loess mantle is thin no separation is made on the engineering soils map.

Some of the areas included in the lacustrine plain are considered as slack water plains from the major river systems or as alluvial plains of the existing river. The delineation between the two is difficult in many places.

The lacustrine or slack water plains are covered by a loess veneer (from 4 to 36 inches or 10 cm to 90 cm). The soil is developed partly from the thin loess cover and partly from the sheet wash materials carried from the uplands. The topsoil varies from silt loam to silty clay loam (A-6, A-7-6) in the high position to silty clay loam or clay (A-7-6) in the low position. The B-horizon varies from a silty clay loam to clay (A-7-6 to A-6). Stratified silt loam, silty clay loam, silty clay, and clay is found in various layers and thickness of the lower strata.

Boring data at site No. 75 is located near the head of the lacustrine plain. It is taken at an elevation of 433.6 feet (132 m) above sea level. The soil profile consists of a 0.5 foot (12 cm) silty clay (A-7-6) topsoil. 3.5 feet (1.07 m) of silty clay loam (A-7-6) subsurface soil and this is underlain by 2.2 feet (67 cm) of silt loam (A-4) soil (13).

Site No. 83 located on a narrow channel at an elevation of 410 feet (125 m) illustrates an anusual profiel (13). The profile is as follows; 2.5 feet (76 cm) silty clay loam (A-6), 4.5 feet (1.37 m) silt clay (A-7-6), 1.5 feet (45 cm) silty clay (A-6), 12.5 feet (3.8 m) silt loam (A-4), 6.5 feet (2 m) loose organic silt loam (A-4), 2.0 feet (60 cm) soft organic clay (A-7-6), 18.5 feet (5.6 m) very loose silt loam, 13.0 feet (4 m) dense and wet organic sand (A-2-4) and then a stiff and moist silty clay loam (A-6). The stratum containing organic materials are likely to be the deposits of the old channel before the sediment of the glacial lake accumulated.

Boring sites from No. 88 to No. 97 are located on the lacustrine plain. The topsoil is a silty clay (A-7-6) between sites No. 88 and 92. It changes in composition slightly and is classified as clay loam (A-6) at site No. 93 and 97. The subsurface soil varies from silty clay loam to silty clay (A-7-6 to A-6).

Site No. 97 is located near the drainage ditch at an elevation of 402.8 feet (130 m). The texture is somewhat coarser. The top layer 1.5 feet (45 cm) is classified as a sandy loam (A-4) soil followed by 3.5 feet (1.27 m) of silty clay (A-7-6) then 4.5 feet (1.38 m) of silt loam and 10.5 feet (3.2 m) of loam (A-6) soil.

The engineering problems associated with the lacustrine or slack water plain are high water table, low load carrying capacity and settlement of heavy structures. The soils are all fine textured.

2. Terrace Deposits

Large terrace deposits are recognized in Posey County. Because the source of the deposit is different, the terraces in the county are subdivided into two parts namely: terrace along the Ohio River and terrace along the Wabash River.

(a) Terrace Along Ohio River

The terrace along the Ohio River is located in the southeastern part of Posey County. It is sandwiched between the lacustrine plain to the north and the Ohio River flood plain to the south. The terrace is at an average altitude of 375 feet (115 m) above sea level. It is about 15 feet (4.5 m) higher than the adjacent flood plain to the south and about 10 feet (3 m) below the lacustrine plain to the north. The terrace shows an elevation of 380 feet (115 m) at the eastern end and this decreases gradually to 373 feet (114 m) at the western end.

The surface is devoid of infiltration basins which are a common feature for coarse-textured terrace deposits. The flat topography is covered by a number of shallow meander scars or drainage channels.

The texture of the terrace varies from place to place. The surface soil ranges from loam to silty clay loam with some organic matter in the low drainage channels. The subsurface soil is a silt loam or silty clay loam. The subsoil texture ranges from silty clay loam to clay. A fragipan usually is found from 20 to 36 inches (50 to 90 cm)

from the surface. This pan slows down the permeability of the deposit greatly. The C-horizon is a stratified silt loam, silty clay loam and fine sand. Sometimes, a thick silt loam layer is encountered.

Because of the poorly drained characteristics, the deposit is usually wet and the bearing strength is reduced accordingly. Frost action and settlement are the problems usually associated with this deposit.

(b) Terrace Along Wabash River

Two large terrace deposits occur along the Wabash River in Posey County. They are on both the northwest corner and the southwestern corner of the county.

Both terraces are relatively flat. The unusually plane-like surface is found in the north central portion along the Black River. The lighter tone areas are slightly higher in topography than the darker tonal areas. The surface is pitted with numerous shallow and small infiltration basins. This is the Maumee (Lake Wisconsian) erosional terrace relict according to Fidler (16). The southern terrace is also a Maumee erosional terrace. However, in addition to the numerous shallow drainage basins, the surface is carved by many current scars.

The terrace along the Wabash River is somewhat coarser in texture than the one along the Ohio River. The texture of the terrace varies greatly from place to place. On the high topographic position the surface soil ranges from a sandy loam to silty clay loam. On the depressed area, however, a clay loam or silty clay surface soil occurs. The B-horizon is slightly more plastic and the C-horizon also varies from a sandy loam to a silty clay loam. The stratifical layer further down consists of sand and some gravel in one place and silty clay loam and silt loam in the other.

Boring along I-64 reveals the variability of the soil texture. The surface soil is classified as sandy loam (A-2-4) at sites Nos. 1, 2, and 25, as sandy clay loam (A-4) at sites No. 28 and 34, as silt loam (A-4) at site No. 35, as clay loam (A-4) at sites 15 to 24 and site 26 and 27, and as silty clay (A-4) at sites No. 3 and 8 (12). The variation in the profile is significant. For example,

at site No. 1 below the 9 inches (23 cm) of snady loam (A-2-4) topsoil is 1.5 feet (45 cm) of clay loam (A-4) then followed by 2.2 feet (65 cm) of sandy loam (A-4) and more than 6.5 feet (2 m) of sand (A-3). At site No. 24 the profile is in the following sequence: 1.0 foot (30 cm) of clay loam (A-4), 1.3 feet (40 cm) of clay (A-6), 5.5 feet (1.68 m) of clay (A-7-6), 2.7 feet (82 cm) of silty clay (A-4), 2.0 feet (50 cm) of sandy loam (A-2-4), 1.5 feet (45 cm) of silty clay (A-4) and more than 3.0 feet (80 cm) of sand (A-1-b) (12).

No appreciable amount of gravels are found in all these borings. This fact is verified by the absence of gravel pits on these terraces. Because of the variability of textures in this deposit, settlement problems are expected in this terrace. For heavy structures and high embankments the subsurface soil is variable and needs to be investigated thoroughly. Frost action of the soil is a problem.

3. Flood Plains or Alluvial Plains

Posey County contains a relatively large amount of flood plains. The extent of mapping of these plains is determined by the scale of the engineering soil map. Small flood plains are not shown.

Due to the different source of alluvial materials and the form of their deposition the flood plains in this county are subdivided into flood plains along the Wabash and Ohio Rivers and flood plains within the loess region.

(A) The Wabash and Ohio River Flood Plains

The Wabash and Ohio River flood plains are subdivided into two groups according to their texture namely: sandy texture and fine texture.

(a) Sandy-Textured Flood Plains

A number of narrow strips along the Wabash River are considered as sandy textured flood plains. Most of them are located adjacent to the river. Some are island like sand bars within the channel. A major flood changes the shape and position of the bars from time to time. The surface of the flood plain is nearly level or gently sloping downstream.

The soil is stratified sand ranging from very coarse to fine sand. the deposit may contain some gravel that ranges from 2 to 25 mm in size. In some areas, thin layers of fine textured material are on the surface or at various depths within the profile. These flood plains are subject to frequent flooding; therefore, they are not suitable for farming unless extensively drained by man-made systems.

Wetness and scouring are the chief problems facing the engineer.

(b) Fine Textured Flood Plains

The majority of the flood plains along both the Wabash and Ohio Rivers are included in this category. The flood plain is a nearly flat surface except where broken by a series of low current scars. The altitude varies from about 375 feet (114 m) at the northwestern corner and 360 feet (110 m) to 335 feet (102 m) above sea level at the junction of the Wabash River and Ohio River. Surface drainage is channeled along the sloughs or scars created by the currents of the flood waters.

The surface soil is quite variable. In the high position sand, loam, silt loam, or silty clay occurs and this is underlain by silt loam to silty clay loam subsoil and stratified loam, silt loam and fine sand further down the profile. In the low topographic position the surface soil varies from a silt loam to clay. The subsoil ranges from a silty clay loam to clay with stratified silt loam or fine sand further down.

Borings along I-64 including sites Nos. 10 to 14 are located in the flood plain region. The topsoil is classified as clay (A-6) soil followed by a more plastic clay (A-7-5 to A-7-6) subsurface soil and then a clay or clay loam (A-6) further down. At site No. 10 a sandy loam (A-4) and sand (A-3) is encountered at a depth 4.9 to 8.4 feet (1.5 to 2.56 m) from the surface. At sites No. 12, 13, and 14 only clay (A-6) or clay loam (A-4) is encountered up to a depth of 8.5 feet (2.6 m) (12).

The major engineering problem in this area is associated with flood, the danger of scour and the weak supporting power of the unconsolidated deposits.

(B) Flood Plain in the Loess Region

All the alluvial plains except those along the Wabash River and the Ohio River in Posey County belong to this category. The depth of these deposits ranges from a few feet at the head water area to about 100 feet (30 m) at the lower reaches of the streams. The deposits of the alluvial plain are derived from the erosion of the surrounding loess covered sandstone and shale uplands. The highly erosive loess fills the valley with silt deposits. The alluvial plain slopes gently from the upper reaches toward the lower reach with a steeper gradient at the upper ends. Channels are dredged and straightened to facilitate drainage of the valley especially along Big Creek where the creek reestablished after deposition of the glacial Lake Solitude deposit. The boundaries between the flood deposit and the lacustrine deposit are difficult to delineate in places.

Since the soil of the region is derived from the uplands, coarse textured materials of a sandy texture are expected adjacent to the foot of the upland and finer textured materials further down stream.

The soil profile varies from a fine sandy loam to a silty clay loam topsoil with a silt loam or a silty clay loam subsurface soil which is underlain by stratified silt loam and silty clay loam. The substrata correlates with the bedrock materials of the adjacent uplands.

Boring data along I-64, at sites Nos. 45 and 46 cross one small channel and sites Nos. 110 and 111 cross the upper reach of Big Creek. Silt loam (A-4) soil is the upper layer of soil in these sites. At site No. 45 there is 11.5 feet (3.5 m) of silt loam over 8.5 feet (2.6 m) of organic silt loam (A-4) and then 2.5 feet (77 cm) of clay (A-6). At site No. 46 a 3.1 feet (95 cm) sandy loam (A-2-4) layer is sandwiched between 13.0 feet (4 m) of silt loam and 10.0 feet (3 m) of clay (A-6) soil. The sites along Big Creek show a thick (more than 8.0 feet or 2.4 m) layer of silty clay loam (A-4) soil.

The engineering problems in this area are associated with high water and frequent flooding. Subgrade support is poor during the wet season. Settlement is a problem for heavy structures.

Miscellaneous

Marsh or Swamp

Along both the Wabash River and Ohio River there are a number of marsh or swamp areas. Except the one near Hovey Lake near the southwestern corner of the county most of them are elongate in shape and somewhat parallel the river system. The area is slightly depressed from its surrounding flood plain. It is wet or swampy most of the time. The site of this deposit is the abandoned channel in general. This soil is well suited for trees as illustrated on the airphotos.

The soil is darker in color than any other soils in the county. The top layer is silty clay to clay (A-6 to A-7-6) soil with organic matter. The substrata is generally a silty clay to clay (A-6 to A-7) soil. Thin layers of silt loam or sandy loam are found interbedded within the silty clay or clayey soil.

The major problem in this area is the wetness and the weak supporting power of the clayey soil.

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APPENDIX A

Loess Thickness Measurements in Posey County by J. B. Fehrenbacker

	Location Description				
Site No.	Township	Range	Section	Total Thickness in Inches	Underlying Material
1	6S	12W	28,SE1/4,SW1/4	115	SS Soil
2	6S	13W	27,SW1/4,SE1/4	135	SS soil
3	6S	12W	4,SW,NE1/4	110	
4	5S	12W	24,SW1/4	100	Heavy Sh. soil
5	4S	13W	13,SE1/4,SW1/4	185	Gritty Ill.till or wash
6	4S	13W	4, SW1/4,SE1/4	350	Gritty Sil. I-till
7	5S	14W	1,NW1/4,SW1/4	360	Cl. Ill-till
8	5S	14W	23,NE1/4,SE1/4	325	Gritty g material
9	5S	14W	26,NW1/4,SW1/4	350 est.	
10	5S	14W	33,NW1/4,NE1/4	300	Gritty till or wash
11	5S	14W	35,SE Corner	250	Gritty till
12	5S	12W	4,NW,SE1/4	130	Heavy Si.Cl.
13	4S	13W	27,NE1/4,NW1/4	185	Gritty Si.L. I-till
14	5S	13W	3,SE Corner	175	Red I-outwash soil
15	5S	13W	21,NW1/4,SE1/4	155	Gritty material
16	6S	13W	31,SW Corner	300	Gritty Si.Cl. residum
17	7S	14W	11,SE1/4,NW1/4	400	Rock
18	7S	12W	12,SE1/4,NW1/4	150	Sh. Sic Soil
19	7S	12W	14,NE Corner	200	Reddish sic residum
20	7S	12W	24,NE1/4,SW1/4	300	SS in bluff to west

APPENDIX B

The soil test data along I-64 tabulated below was obtained from consultant's reports prepared for the Indiana State Highway Commission. The location of the site is shown on the attached engineering soils map. Considerable additional data is contained in the consultant's reports.

Site	Station	Offset (ft.)	Depth (ft.)	Texture	AASHTO Classification	Percent				L.L.	P.L.	P.I.	S.L.
						Gravel	Sand	Silt	Clay				
1	33+00	44 Lt	0.8-2.3	Cl.L.	A-4(7)	0	32	43	25	27	20	7	16
2	36+00	44 Rt	0.0-2.6	Sa.L.	A-2-4(0)	0	78	9	13	NP	NP	NP	--
3	39+00	44 Lt	0.8-2.0	Clay	A-6(7)	0	40	25	35	34	20	14	13
			7.0-9.0	Sand	A-3(0)	4	89	2	5	NP	NP	NP	--
4	46+00	44 Lt	5.5-7.0	Si.Cl.L.	A-4(8)	0	26	51	23	26	19	7	16
5	49+70	44 Rt	0.6-2.4	Si.Cl.	A-6(9)	0	8	61	31	38	25	13	16
6	57+00	44 Lt	1.2-2.6	Sa.L.	A-4(0)	0	64	21	15	NP	NP	NP	--
7	66+00	44 Rt	0.0-0.8	Si.Cl.	A-4(8)	0	11	52	37	32	23	9	17
8	69+00	44 Lt	4.0-6.0	Clay	A-6(8)	0	22	45	33	31	20	11	14
9	81+00	44 Lt	1.5-3.0	Clay	A-7-6(16)	0	4	49	47	51	25	26	12
			4.5-6.5	Si.Cl.	A-6(12)	0	3	60	37	39	20	19	17
			6.5-8.0	Cl.L.	A-6(10)	0	26	47	27	31	17	14	16
10	105+00	44 Lt	8.5-11.0	Sand	A-3(0)	1	92	1	6	NP	NP	NP	--
11	111+00	44 Lt	0.0-0.8	Clay	A-6(9)	1	21	38	40	37	24	13	14
			3.5-6.6	Clay	A-6(10)	0	24	45	31	35	20	15	14
			6.6-8.5	Cl.L.	A-4(4)	0	45	31	24	27	19	8	14
			8.5-11.0	Sa.L.	A-4(1)	0	60	22	18	NP	NP	NP	--
12	117+00	44 Lt	6.0-8.0	Si.Cl.	A-7-6(15)	0	6	53	41	46	22	24	15
13	123+00	44 Lt	1.0-6.5	Clay	A-7-6(15)	1	9	36	54	53	31	22	14
14	129+00	44 Lt	0.8-1.5	Clay	A-6(9)	0	11	48	41	37	24	13	15
15	144+00	44 Rt	0.5-2.5	Cl.L.	A-6(3)	0	50	22	28	28	17	11	13
			6.0-8.0	Sa.L.	A-2-4(0)	0	75	12	13	NP	NP	NP	--

						Percent							
Site	Station	Offset (ft.)	Depth (ft.)	Texture	AASHTO Classification	Gravel	Sand	Silt	Clay	L.L.	P.L.	P.I.	S.L.
16	147+00	44 Lt	4.0-6.5	Clay	A-7-6(15)	0	10	38	52	46	22	24	13
			6.5-8.0	Cl.L.	A-4(5)	0	39	37	24	25	16	9	11
17	159+00	42 Lt	6.0-7.0	Cl.L.	A-4(7)	3	28	43	26	28	19	9	16
18	176+50	37 Lt	0.0-1.0	Cl.L.	A-4(6)	0	35	41	24	26	20	6	19
			1.0-2.0	Cl.L.	A-4(5)	1	39	38	21	22	17	5	16
			2.0-4.2	Clay	A-6(9)	2	30	33	35	36	19	17	14
			4.2-6.5	Clay	A-6(12)	1	29	34	36	40	18	22	12
19	180+00	37 Rt	0.0-1.6	Cl.L.	A-4(4)	1	42	37	20	NP	NP	NP	--
20	183+00	37 Lt	4.5-6.5	Sa.L.	A-2-4(0)	5	70	8	17	NP	NP	NP	--
21	210+00	37 Lt	6.5-8.0	Sa.L.	A-2-4(0)	0	79	5	16	NP	NP	NP	--
22	219+00	37 Lt	0.8-2.2	Sa.L.	A-4(1)	2	60	19	19	NP	NP	NP	--
			5.5-8.0	Sa.Cl.L.	A-4(2)	1	53	20	26	28	19	9	13
23	228+00	37 Rt	7.0-9.0	Sa.L.	A-2-4(0)	0	67	13	20	23	18	5	13
24	234+00	37 Rt	12.5-14.0	Si.Cl.	A-4(8)	0	12	56	32	33	23	10	18
25	237+00	37 Lt	0.0-0.8	Sa.L.	A-2-4(0)	0	65	20	15	NP	NP	NP	--
			4.5-6.0	Cl.L.	A-4(5)	0	42	34	24	28	19	9	17
			8.5-10.0	Sand	A-1-b(0)	15	71	7	7	NP	NP	NP	--
26	246+00	37 Rt	0.0-1.5	Cl.L.	A-4(6)	0	35	42	23	25	19	6	13
			2.2-3.0	Clay	A-7-5(16)	0	4	40	56	56	32	24	16
			5.0-7.0	Clay	A-7-6(15)	0	4	48	48	47	23	24	14
27	252+00	37 Rt	1.0-2.0	Clay	A-6(5)	0	40	25	35	31	20	11	10
28	264+20	37 Rt	4.6-6.0	Sa.Cl.L.	A-2-4(0)	1	72	6	21	NP	NP	NP	--
29	273+00	37 Lt	6.4-8.0	Sa.L.	A-2-4(0)	0	71	10	19	NP	NP	NP	--
30	276+00	37 Rt	0.0-0.8	Sa.Cl.L.	A-4(2)	0	55	18	27	26	20	6	13
31	279+00	37 Lt	8.0-10.0	Sand	A-1-b(0)	18	81	3	6	NP	NP	NP	--
32	318+00	37 Lt	8.0-10.0	Sand	A-1-b(0)	36	53	7	4	NP	NP	NP	--

Site	Station	Offset (ft.)	Depth (ft.)	Texture	AASHTO Classification	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	L.L.	P.L.	P.I.	S.L.
33	324+00	37 Lt	2.5-4.5	Sa.L.	A-2-4(0)	2	76	6	16	NP	NP	NP	--
34	333+25	37 Rt	8.5-10.0	Si.Cl.L.	A-4(8)	0	19	61	20	31	23	8	18
35	338+00	37 Lt	0.0-2.0	Si.L.	A-4(8)	0	5	77	18	37	34	3	18
			6.5-8.0	Si.Cl.L.	A-4(8)	0	18	58	24	30	24	6	15
			11.0-12.5	Si.L.	A-4(6)	0	36	51	13	NP	NP	NP	--
36	343+50	37 Lt	10.0-12.0	Si.L.	A-4(8)	0	4	86	10	NP	NP	NP	--
			39.0-42.0	Clay	A-7-6(13)	1	20	45	34	42	21	21	16
			45.5-48.0	Sa.L.	A-4(1)	0	60	22	18	25	23	2	19
			48.0-50.0	Cl.L.	A-4(3)	3	45	30	22	28	19	9	16
37	350+28	37 Lt	0.0-1.0	Si.L.	A-4(8)	0	4	78	18	38	31	7	26
			20.0-22.0	Si.L.	A-4(8)	0	1	85	14	NP	NP	NP	--
			30.0-32.0	Si.L.	A-4(8)	0	0	88	12	NP	NP	NP	--
38	352+50	37 Rt	5.5-7.5	Sand	A-2-4(0)	0	88	5	7	NP	NP	NP	--
			39.5-42.5	Si.Cl.L.	A-4(8)	0	3	76	21	28	22	6	18
39	358+15	37 Rt	5.5-8.5	Si.Cl.L.	A-4(8)	0	8	69	23	31	25	6	20
40	359+50	37 Rt	0.8-2.5	Si.Cl.	A-7-6(12)	0	1	59	40	47	29	18	14
41	367+00	37 Rt	0.0-2.0	Clay	A-7-5(15)	0	8	50	42	54	33	21	15
42	368+25	37 Lt	8,0-10.0	Si.Cl.	A-6(12)	0	12	51	37	40	21	19	16
43	373+00	37 Lt	9.5-12.0	Si.L.	A-4(8)	0	2	87	11	23	19	4	21
			30.0-32.0	Si.Cl.L.	A-4(8)	0	3	74	23	26	16	10	17
44	400+00A	37 Rt	1.0-2.0	Si.Cl.	A-7-6(17)	0	1.6	65.2	33.2	47.4	17.9	29.5	16.9
			8.0-15.0	Si.L.	A-4(8)	0	1.8	86.1	12.1	24.1	20.0	4.1	19.3
			39.0-40.0	Sa.Cl.L.	A-6(4)	12.4	51.3	18.8	17.5	34.6	14.1	20.5	13.5
45	404+00A	37 Rt	16.5-17.0	Si.L.	A-4(8)	0.6	19.8	65.3	14.3	30.2	29.2	1.0	25.8
46	406+00A	37 Lt	14.0-15.0	Clay	A-6(14)	0.5	3.3	44.9	51.3	40.2	16.5	23.7	16.7
47	411+00AR	37 Rt	8.5-10.0	Sa.L.	A-2-4(0)	0	66.5	31.2	2.3	NP	NP	NP	--
			33.5-35.0	Si.Cl.L.	A-4(8)	0	13.0	66.6	20.4	21.9	14.8	7.1	15.0

Site	Station	Offset (ft.)	Depth (ft.)	Texture	AASHTO Classification	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	L.L.	P.L.	P.I.	S.L.
48	416+00AR	37 Rt	5.0-6.0	Si.L.	A-4(8)	9	20.4	61.0	18.6	19.3	15.7	3.6	16.0
			20.0-21.0	Si.L.	A-4(8)	0	0.6	89.8	9.6	NP	NP	NP	21.1
49	422+30A	37 Lt	11.0-12.0	Clay	A-6(11)	0	10.0	49.3	40.7	37.0	19.8	17.2	19.1
50	429+00AR	37 Rt	5.0-6.0	Sa.L.	A-2-4(0)	0	66.6	28.0	5.4	NP	NP	NP	--
51	431+50AR	37 Rt	3.0-4.0	Si.Cl.	A-7-6(17)	0	1.9	66.3	31.8	47.0	18.0	29.0	17.9
52	434+65AR	37 Rt	10.0-10.5	Si.L.	A-4(8)	0.4	12.7	67.6	19.3	27.1	18.4	8.7	17.8
53	444+00AR	37 Rt	18.0-19.0	Si.L.	A-4(8)	0	0.5	91.2	8.3	NP	NP	NP	21.9
54	447+00AR	37 Rt	7.0-15.0	Si.L.	A-4(8)	0	1.1	85.3	13.6	28.4	20.9	7.5	21.2
55	454+75AR	37 Rt	11.0-12.5	Cl.L.	A-6(10)	1.3	30.0	41.7	27.0	29.2	12.8	16.4	15.1
56	461+50A	37 Lt	9.0-10.0	Si.L.	A-4(8)	0	0.4	88.6	11.0	25.4	22.7	2.7	21.7
57	464+35AR	37 Rt	12.0-13.0	L	A-4(3)	1.2	48.7	32.4	17.7	21.1	14.8	6.3	14.0
58	465+50A	37 Lt	12.0-13.0	Si.L.	A-4(8)	0	3.6	82.4	14.0	34.5	28.7	5.8	26.4
59	467+00AR	37 Rt	3.0-4.0	Si.Cl.	A-7-6(18)	0	1.0	68.1	30.9	51.8	21.1	30.7	18.9
60	473+50A	37 Lt	3.0-4.0	Si.Cl.L.	A-7-6(14)	0	0.5	70.9	28.6	42.6	19.7	22.9	19.5
			12.0-13.0	Si.L.	A-4(8)	0	4.7	82.9	12.4	25.5	19.4	6.1	19.4
61	485+80AR	37 Rt	10.0-11.0	Cl.L.	A-6(12)	1.0	31.2	40.5	27.3	34.2	12.5	21.7	12.2
62	489+00AR	37 Rt	4.0-5.0	Si.L.	A-6(8)	0.2	9.8	73.8	16.2	31.4	20.4	11.0	20.3
63	494+00A	37 Lt	3.0-4.0	Si.L.	A-6(10)	1.8	4.3	77.5	16.4	35.5	20.2	15.3	18.8
64	504+00A	37 Lt	1.0-2.0	Si.Cl.	A-7-6(16)	0	0.6	66.8	32.6	46.1	18.3	27.8	17.3
65	510+00A	37 Lt	3.0-4.0	Si.L.	A-4(8)	1.2	3.3	84.7	10.8	25.3	23.2	2.1	21.9
66	516+50A	37 Lt	5.0-6.0	Si.Cl.L.	A-6(12)	1.3	2.6	69.5	26.6	39.2	18.3	20.9	18.0
67	525+30A	37 Rt	16.0-17.5	Cl.L.	A-6(10)	1.2	30.0	41.0	27.8	31.0	13.3	17.7	14.4
68	527+10A	37 Lt	3.0-4.0	Si.Cl.L.	A-6(11)	0.3	1.9	75.4	22.4	36.0	19.3	16.7	19.7
69	529+00A	37 Rt	5.0-6.0	Si.L.	A-4(8)	0.3	1.3	86.1	12.3	27.4	22.9	4.5	23.3

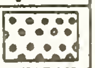
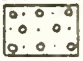
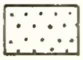
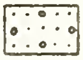
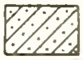
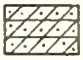
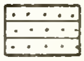
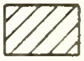
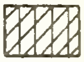
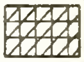
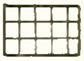
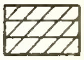
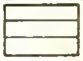
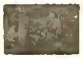
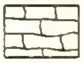
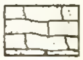
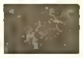
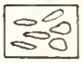
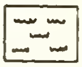
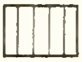
Site	Station	Offset (ft.)	Depth (ft.)	Texture	AASHTO Classification	Percent				L.L.	P.L.	P.I.	S.L.
						Gravel	Sand	Silt	Clay				
70	535+00A	37 Lt	5.0-6.0	Si.L.	A-4(8)	0.7	2.5	80.3	16.5	29.6	20.8	8.8	22.2
71	545+30A	37 Lt	1.0-2.0	Si.Cl.L.	A-6(9)	0	0.7	75.6	23.7	31.8	19.8	12.0	21.3
72	554+00A	37 Rt	1.0-2.0	Si.L.	A-4(8)	0	2.1	79.0	18.9	25.7	20.9	4.8	22.3
73	566+70A	37 Rt	1.0-2.0	Si.Cl.	A-7-6(19)	0	2.2	62.3	35.5	54.0	21.2	32.8	17.8
74	570+50A	37 Lt	1.0-2.0	Si.Cl.	A-7-6(17)	0	2.9	62.9	34.2	49.1	21.1	28.0	20.8
75	573+50A	37 Rt	3.0-4.0	Si.Cl.L.	A-7-6(14)	0	1.5	74.5	24.0	44.3	22.4	21.9	20.5
76	585+00A	37 Rt	1.0-2.0	Si.Cl.	A-7-6(16)	0	4.7	61.6	33.7	46.4	19.0	27.4	17.8
77	591+00A	37 Rt	1.0-2.0	Si.Cl.	A-7-6(18)	0	0.8	64.9	34.3	49.8	19.9	29.9	17.0
			7.0-8.0	Si.L.	A-4(8)	2.4	3.0	81.9	12.7	25.4	20.9	4.5	20.8
78	599+00A	37 Lt	3.0-4.0	Si.Cl.	A-7-6(17)	0	4.0	65.1	30.9	46.9	17.6	29.3	14.0
79	604+00A	37 Lt	1.0-2.0	Si.Cl.	A-7-6(20)	0	0.8	55.1	44.1	66.3	22.9	43.4	12.4
80	615+00A	37 Lt	0.0-1.0	Si.Cl.L.	A-6(10)	0.1	3.7	71.2	25.0	37.0	21.5	15.5	22.1
			1.0-2.0	Si.Cl.	A-7-6(18)	0	0.5	63.0	36.5	52.5	17.1	35.4	16.6
81	618+00A	37 Rt	9.0-10.0	Si.L.	A-4(8)	0	0.3	86.8	12.9	NP	NP	NP	22.9
82	621+00A	37 Lt	3.0-4.0	Si.Cl.L.	A-6(9)	0.3	3.5	71.4	24.8	32.2	19.5	12.7	--
83	632+50A	37 Rt	5.0-6.0	Si.Cl.	A-7-6(15)	0	2.6	66.1	31.3	43.0	17.9	25.1	16.5
		100 Rt	24.0-24.5	Org. Clay	A-7-6(19)	0	1.9	26.8	71.3	55.2	20.1	35.1	19.9
			33.5-34.0	Org.Si.L.	A-4(8)	0	2.5	88.5	9.0	29.9	24.3	5.6	24.3
			45.0-46.5	Sand	A-2-4(0)	16.8	74.4	6.0	2.8	NP	NP	NP	--
84	639+15A	37 Rt	5.0-10.0	Si.L.	A-4(8)	1.6	3.3	84.3	10.8	24.7	NP	NP	22.0
			19.0-20.0	Sa.L.	A-4(0)	1.9	61.9	19.1	17.1	19.2	10.8	8.4	12.1
			25.0-26.0	Sa.L.	A-4(1)	1.5	58.8	22.0	17.7	22.0	12.5	9.5	15.5
			30.0-31.0	L.	A-6(4)	3.2	48.0	31.4	17.4	24.4	12.8	11.6	13.2
85	660+00A	37 Lt	9.0-10.0	Si.L.	A-4(8)	0	0.2	88.4	11.4	25.7	19.2	6.5	21.3
86	663+00A	37 Rt	9.0-10.0	Si.L.	A-4(8)	0.5	2.8	82.2	14.5	24.1	18.6	5.5	21.0

Site	Station	Offset (ft.)	Depth (ft.)	Texture	AASHTO Classification	Percent				L.L.	P.L.	P.I.	S.L.
						Gravel	Sand	Silt	Clay				
87	672+00A	37 Lt	1.0-2.0	Si.Cl.	A-7-6(14)	0.4	4.6	63.2	31.8	41.5	18.1	23.4	15.6
			5.0-6.0	Si.Cl.	A-7-6(14)	0	5.2	59.1	35.7	41.4	18.3	23.1	16.5
88	675+00A	37 Rt	5.0-6.0	Si.Cl.	A-7-6(16)	0	6.6	62.7	30.7	44.2	17.8	26.4	15.9
89	684+00A	37 Lt	1.0-2.0	Si.Cl.L.	A-7-6(14)	0	4.8	66.1	29.1	44.0	20.8	23.2	16.2
90	689+50A	37 Lt	3.0-4.0	Si.Cl.L.	A-6(13)	0.4	5.3	64.6	29.7	39.9	17.3	22.6	14.9
91	692+00A	37 Rt	11.0-12.0	Si.Cl.L.	A-6(9)	0	4.5	69.0	26.5	28.7	15.0	13.7	17.9
92	698+00A	37 Rt	3.0-4.0	Si.Cl.L.	A-6(12)	0.3	13.3	58.6	27.8	37.4	16.9	20.5	16.7
93	707+00A	37 Lt	0.0-1.0	Cl.L.	A-6(10)	0.2	23.6	48.6	27.6	34.1	18.0	16.1	18.5
			13.0-14.0	Clay	A-6(12)	0.2	9.6	45.1	45.1	36.9	16.6	20.3	16.3
94	710+00A	37 Rt	7.0-8.0	Loam	A-4(4)	1.9	43.4	38.8	15.9	20.1	18.5	1.6	15.8
			21.0-22.0	Si.L.	A-4(8)	0	3.0	85.1	11.9	22.4	18.1	4.3	19.6
95	713+00A	37 Lt	7.5-8.0	Si.Cl.L.	A-6(9)	0.2	16.8	59.3	23.7	28.5	16.6	11.9	18.0
			12.5-13.0	Si.Cl.	A-6(10)	0	0.2	61.2	38.6	33.9	19.8	14.1	16.9
			21.0-22.5	Si.L.	A-4(8)	0	4.5	82.2	13.3	22.8	19.3	3.5	--
			24.5-25.0	Si.Cl.L.	A-6(11)	1.1	18.3	52.7	27.9	33.0	14.7	18.3	--
			33.5-35.0	Sa.L.	A-2-4(0)	4.7	68.5	21.5	5.3	NP	NP	NP	--
96	717+00	37 Lt	7.0-10.5	Sa.L.	A-4(1)	1	65	28	6	20	20	NP	19
97	721+00	37 Lt	17.5-19.0	Cl.L.	A-7-6(11)	0	23	50	27	41	24	17	19
98	743+00	37 Lt	7.5-10.0	Si.L.	A-4(8)	0	6	78	16	26	24	2	13
99	754+00	37 Lt	0.0-5.0	Si.Cl.	A-7-6	(opt. MC 19.6%; Max DD 106 pcf; CBR 7%)							
			5.0-11.0	Si.L.	A-4	(opt. MC 14.4%; Max DD 110.6 pcf; CBR 14%)							
100	763-00	37 Rt	10.0-13.0	Loam	A-6(5)	20	35	30	15	31	20	11	21
101	769+00	37 Lt	0.4-3.5	Si.Cl.	A-7-6(20)	0	4	60	36	59	26	33	22
102	790+50	37 Lt	4.0-6.0	Cl.L.	A-7-6(14)	5	29	41	25	44	21	23	18
103	801+00	37 Lt	2.0-7.0	Si.Cl.L.	A-6(9)	2	12	64	22	33	20	13	19
104	810+00	37 Rt	14.0-17.0	Sa.L.	A-6(3)	1	50	30	19	26	15	11	18

Site	Station	Offset (ft.)	Depth (ft.)	Texture	AASHTO Classification	Percent Gravel	Percent Sand	Percent Silt	Percent Clay	L.L.	P.L.	P.I.	S.L.
105	819+00	37 Rt	3.0-7.0	Silt	A-4(8)	0	2	81	17	31	25	6	25
			7.0-10.0	Si.Cl.L.	A-6(10)	1	14	57	28	35	20	15	18
106	854+00	85 Rt	5.0-10.0	Si.L.	A-4(8)	0	6	79	15	27	22	5	20
107	861+00	37 Lt	19.0-23.0	Cl.L.	A-6(5)	3	46	30	21	29	16	13	15
108	864+00	37 Rt	8.0-15.0	Si.Cl.L.	A-4(8)	2	24	52	22	28	18	10	15
109	870+00	37 Rt	6.0-10.0	Si.L.	A-4(8)	0	13	68	19	29	23	6	23
110	886+00	37 Lt	3.0-5.0	Si.Cl.L.	A-4(8)	0	5	74	21	30	23	7	24
111	890+00	37 Lt	0.6-7.0	Si.Cl.L.	A-4(8)	0	7	72	21	28	21	7	23
112	925+00	37 Rt	12.0-20.0	Sa.L.	A-4	(opt. MC 14.4%; Max DD 114.4 pcf; CBR 6%)							
113	937+00	27 Rt	14.5-20.0	Sa.L.	A-4(3)	4	70	13	13	24	18	6	19
114	940+00	37 Lt	8.0-13.0	Cl.L.	A-6(8)	9	56	36	19	35	18	17	16
115	951+00	37 Lt	0.4-4.5	Si.Cl.	A-7-6	0	12	57	31	49	23	26	18
116	972+00	37 Lt	2.0-4.0	Si.Cl.L.	A-7-6(13)	0	1	73	26	43	21	22	17
			4.0-6.0	Si.L.	A-4(8)	0	1	86	13	33	24	9	21

APPENDIX C

SOIL CLASSIFICATION AND PROFILE SYMBOLS

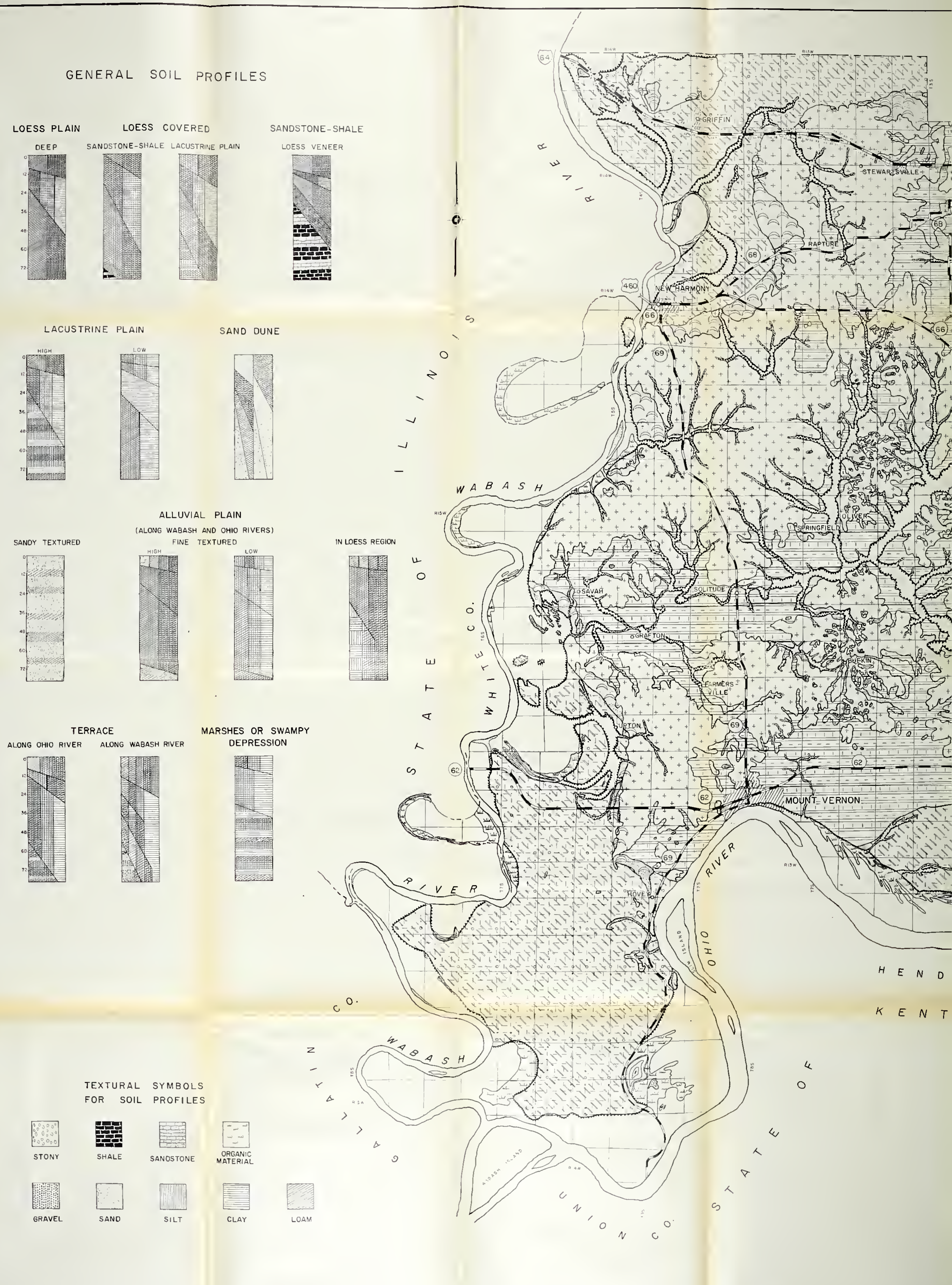
Description	Grain Size Distribution				Plastic Index	Symbol
	Gravel % Retained on #10	Sand #10-#200	Silt 0.05-0.005mm	Clay Less than 0.005mm		
Gravel	85-100	0-15	0-10	0-10	NP	
Sandy Gravel	50-85	15-50	0-10	0-10	6 Max.	
Sand	0-15	85-100	0-10	0-10	NP	
Gravelly Sand	20-49	45-85	0-10	0-10	6 Max.	
Sandy Loam	0-19	50-80	0-50	0-20	6 Max.	
Sandy Clay Loam	0-19	50-80	0-30	20-30	10 Max.	
Sandy Clay	0-19	55-70	0-15	30-45	11 Min.	
Loam	0-19	30-50	30-50	0-20	10 Max.	
Silt Loam	0-19	0-50	50-100	0-20	10 Max.	
Silty Clay Loam	0-19	0-30	70-100	20-30	11 Min.	
Silty Clay	0-19	0-15	55-70	30-45	11 Min.	
Clay Loam	0-19	20-50	50-80	20-30	11 Min.	
Clay	0-19	0-55	0-55	30-100	11 Min.	
Peat or Muck						
Limestone						
Sandstone						
Shale						
Stony Fragments						
Organic Matter						
Top soil						

Classification of Gravelly Soils

85%-100% gravel plus finer material - Gravel
50%-84% gravel plus finer material - Clayey, silty or sandy gravel
20%-49% gravel plus finer material - Use fine classification and called gravelly sand, gravelly silt or gravelly clay
0%-19% gravel plus finer material - Use fine classification only

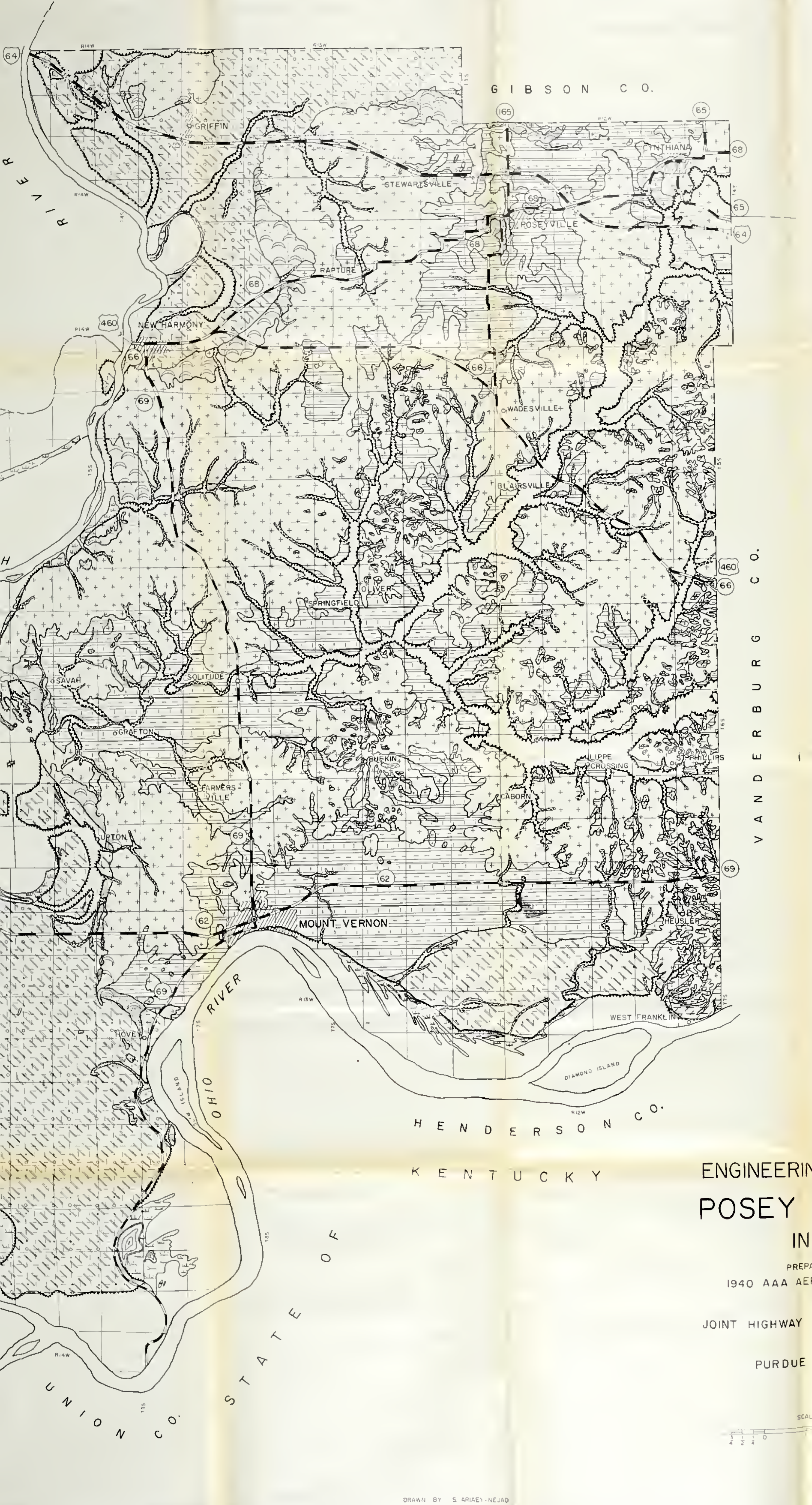
JHRP - 82/6

JHRP - 82/6



PREPARED UNDER THE SUPERVISION OF PT YEH

DRAWN BY S ARIAEY-NEJAD



LEGEND

PARENT MATERIAL
(GROUPED ACCORDING LAND FORM AND ORIGIN)

- DEEP LOESS PLAIN
- LOESS COVERED LACUSTRINE PLAIN
- LOESS COVERED SANDSTONE - SHALE
- INTERBEDDED SANDSTONE-SHALE WITH LOESS VENEER
- TERRACE
- LACUSTRINE PLAIN
- ALLUVIAL PLAIN
- SAND DUNE
- MARSHES OR SWAMPY DEPRESSION

MISCELLANEOUS

- BORING SITE
- LAKE OR POND

TEXTURAL SYMBOLS
(SUPERIMPOSED ON PARENT MATERIAL TO SHOW RELATIVE COMPOSITION)

- GRAVEL
- SAND
- SILT
- CLAY

ENGINEERING SOILS MAP
POSEY COUNTY
INDIANA

PREPARED FROM
1940 AAA AERIAL PHOTOGRAPHS
BY
JOINT HIGHWAY RESEARCH PROJECT
AT
PURDUE UNIVERSITY

1982

SCALE OF MILES
0 1 2 3 4

DRAWN BY S. ARIAEY-NEJAD

COVER DESIGN BY ALDO GIORGINI